

INDIA

RUBBER WORLD

OUR

62nd YEAR



FEBRUARY, 1951



Washington says: "Retread to Conserve Rubber"

Cabot Customers Say:

PUBLIC LIBRARY
FEB 13, 1951
DETROIT

**"Use Vulcan 3 for Best
Tread Wear in Synthetic
Rubber Camelback"**

*...and for Smooth Processing
Good Extrusion Characteristics
Eye Appeal*

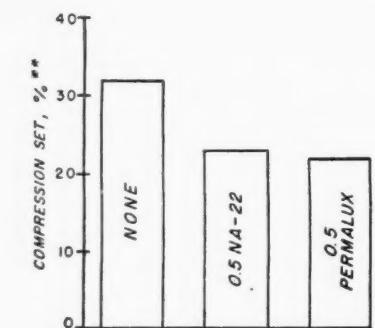
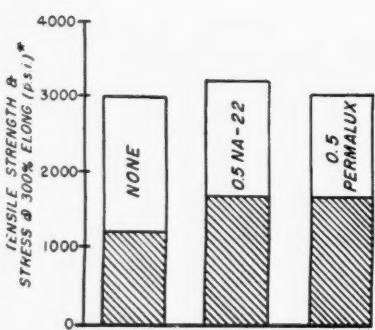
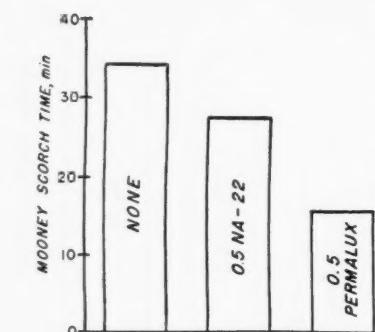
GODFREY L. CABOT, INC.

77 FRANKLIN STREET, BOSTON 10, MASS.

TEST RECIPE

Neoprene Type GN	100.0
NEOZONE A	2.0
Stearic Acid	0.5
Extra Light Calcined Magnesia	4.0
SRF Carbon Black	29.0
Zinc Oxide	5.0

Acceleration as Shown



*Specimens cured 10 min. (a) 307° F.

**Specimens cured 40 min. (a) 307° F.

Set determined at 30% constant deflection in accordance with ASTM D 395.

Du Pont NA-22

An outstanding neoprene accelerator for fast, tight cures at minimum cost and maximum safety

In Neoprene Types GN, GN-A and RT stocks, NA-22 combines powerful activation at curing temperatures with excellent processing safety. Data in the graphs shown here compare the effectiveness of NA-22 with that of Permalux in a Type GN stock. NA-22 is considerably less expensive than Permalux. Yet it provides the same high state of cure in the same time and is much safer, as shown by the Mooney scorch data. There are other advantages, too; NA-22 provides increased heat resistance, is non-staining and non-discoloring. And NA-22 exhibits a slight delayed action which permits better mold flow.

With the other neoprenes, too, NA-22 has been found to be unusually efficient. In Type FR it provides a balance of properties which include good heat resistance and processing safety. Type W compounds containing NA-22 are characterized by excellent set properties and exceptional heat resistance.

If you have not tried NA-22 in your neoprene stocks we strongly urge you to do so. We will be glad to provide samples for your evaluation. For complete information on NA-22 consult Report 50-1. If you've misplaced your copy, see your Du Pont representative or write:

RUBBER CHEMICALS DIVISION
E. I. DU PONT DE NEMOURS & COMPANY, (INC.)
WILMINGTON 98, DELAWARE

Tune in to Du Pont "CAVALCADE OF AMERICA" Tuesday Nights—NBC coast to coast

DU PONT RUBBER CHEMICALS

E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Del.



BETTER THINGS FOR BETTER LIVING...THROUGH CHEMISTRY

**Another new development using
B. F. Goodrich Chemical Company raw materials**

NEW IDEA IN OIL FILTERS

**- a re-usable
Hycar
GASKET!**



*Oil filter by Pur-O-lator
Products, Inc., Rahway, N. J.
B. F. Goodrich Chemical Co.
does not manufacture this gasket.
We supply raw materials only.*

IDEA-MEN are always finding some new sales-making use for Hycar—like the gasket for a new type oil filter pictured here. Because of Hycar's many advantages over materials formerly used, this gasket can be used over and over—whenever the filter is replaced. Permanency of seal and retention of oil are *assured*!

For use in parts that must withstand oil, gasoline and other deteriorating fluids, Hycar can be compounded to provide low absorption. Yet, it remains practically unchanged in hardness, elongation and tensile strength

even after prolonged exposure.

Excellent resistance to cold flow and compression set are characteristic of Hycar compounds. They exhibit good flex-life and have extreme resistance to oxidation and aging.

What Hycar does for this gasket may give you an idea for improving or developing a product. Any one, or combination of Hycar's advantages—resistance to oil, gas, heat and cold, weather and wear—may be just what you need. We make no finished products—supply raw materials only. But our staff is always ready to help you with technical

service. Just write Dept. HB-1, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, O. Cable address: Goodchemco.

B. F. Goodrich Chemical Company
A Division of The B. F. Goodrich Company

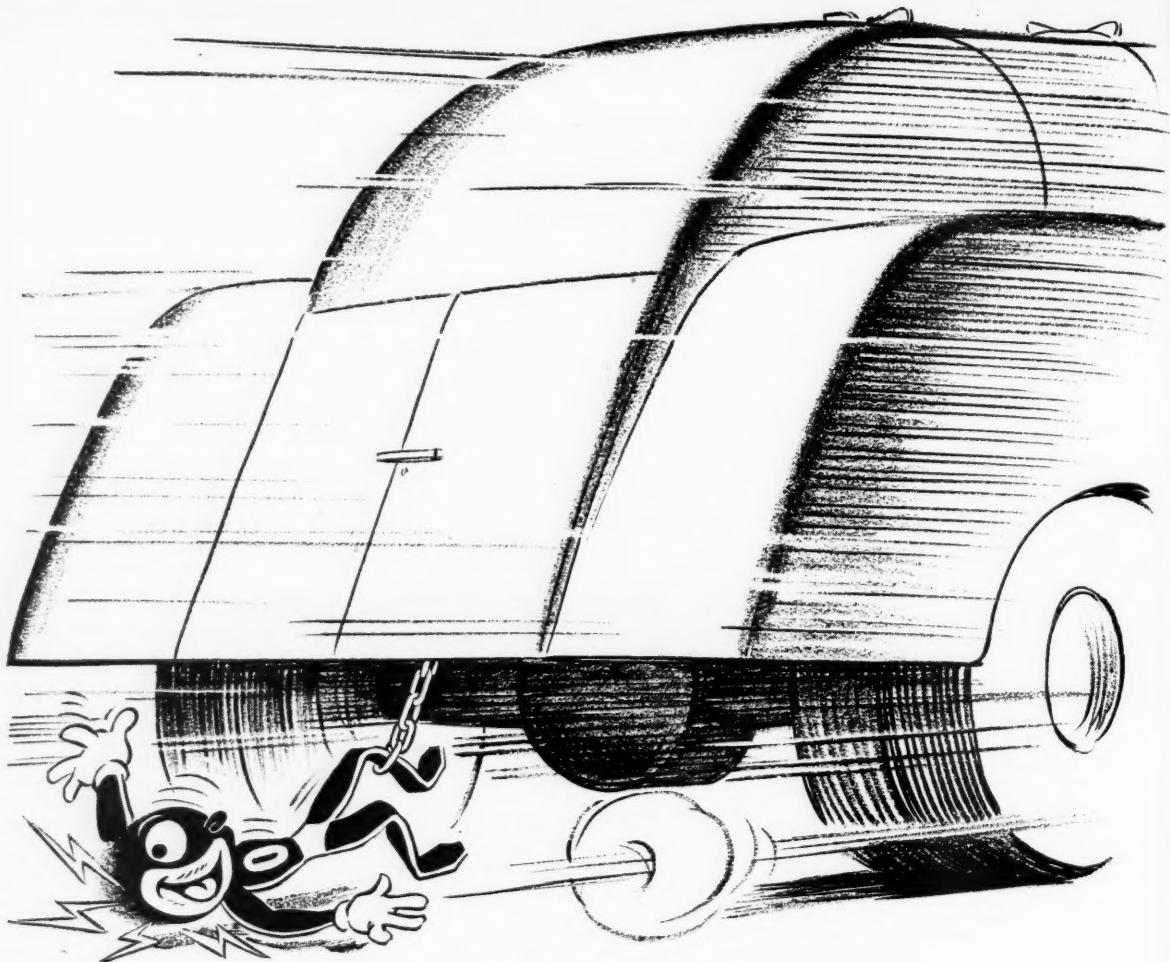
**Need extreme temperature resistance?
Hycar has it—plus abrasion resistance
and more advantages**

Hycar
Reg. U. S. Pat. Off.
American Rubber

GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers

February, 1951

511



For conductivity that's high
Philblack® O is the black to buy!

Minimize the buildup of dangerous static electricity, at a reasonable cost and without sacrifice of other desirable physical properties, by incorporating Philblack O in your rubber stocks. Tire treads, conveyor belts, industrial hose and many other rubber products will give more satisfactory service if advantage is taken of the high electrical conductivity provided by Philblack O. High conductivity, along with reasonable cost, exceptional abrasion resistance, excellent flex life and good aging qualities make Philblack O an outstanding choice for these applications.

Our technical service representatives are available to consult with and assist you in compounding and processing problems. Philblack O is shipped in bags or in bulk in hopper cars specially designed to facilitate unloading.

PHILLIPS CHEMICAL COMPANY

PHILBLACK SALES DIVISION

EVANS BUILDING • AKRON 8, OHIO

Philblack A and Philblack O are manufactured at Borger, Texas.

Warehouses in Akron, Boston, Chicago and Trenton. West Coast agent: Harwick Standard Chemical Company, Los Angeles. Canadian agent: H. L. Blachford, Ltd., Montreal and Toronto.



*A Trademark

INDIA RUBBER WORLD

Announcement...

Naugatuck Chemical is now producing and distributing



**An Acrylonitrile — Butadiene Polymer... outstanding
for its resistance to oils and gasolines**

PARACRIL B

General Purpose Oil.
Resistant Type—Excellent
Heat Resistance.

PARACRIL-BJ

Same General use as "B"
but lower plasticity and easier
processing.

PARACRIL-C

Maximum Oil Resistance. Excellent heat
resistance and aging properties.

Price list available upon request

**Process • Accelerate • Protect
with**

NAUGATUCK CHEMICALS



Naugatuck Chemical

DIVISION OF UNITED STATES RUBBER COMPANY

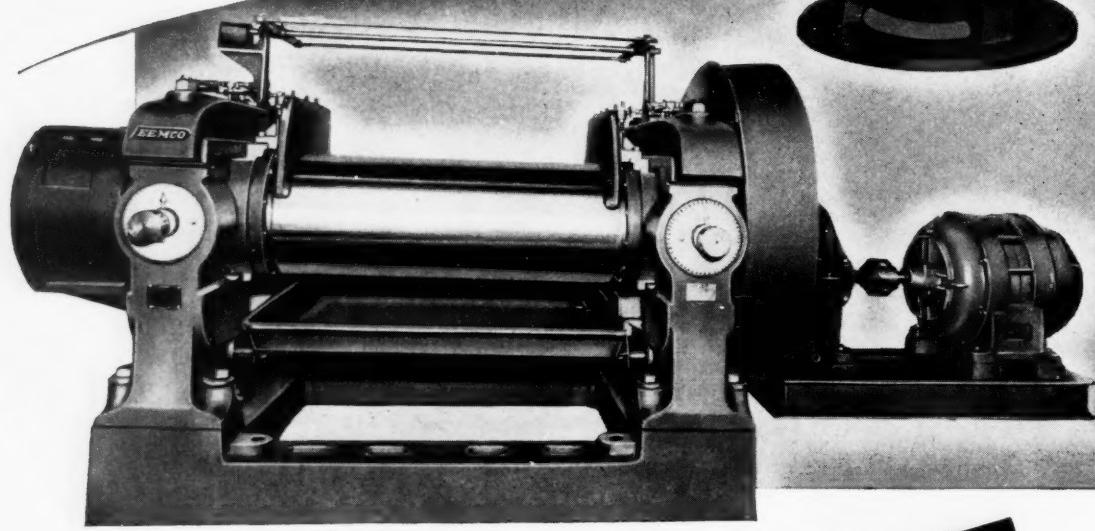
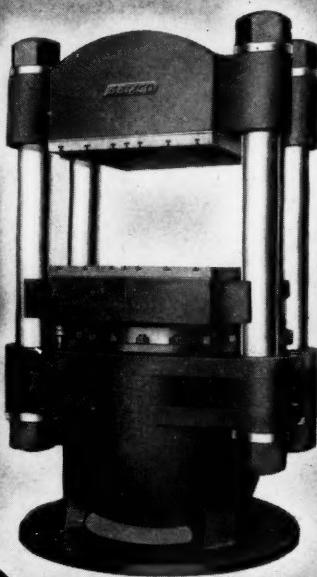
NAUGATUCK, CONNECTICUT

IN CANADA: NAUGATUCK CHEMICALS DIVISION • Dominion Rubber Company Limited, Elmira, Ontario

RUBBER CHEMICALS • AROMATICS • SYNTHETIC RUBBER • PLASTICS • AGRICULTURAL CHEMICALS • RECLAIMED RUBBER • LATICES



GET
EEMCO'S
ESTIMATE
BEFORE
YOU BUY



Yes, you will profit, as have many others, if you write to EEMCO for their proposition on Rubber and Plastics Processing Machinery. Engineered right, built right and of best obtainable materials you are assured of longer life and better production when you select EEMCO. If your present or future needs include any of the machines listed below, write EEMCO for a quotation. You will like their attractive prices and quicker deliveries. Standard and custom made, of course.

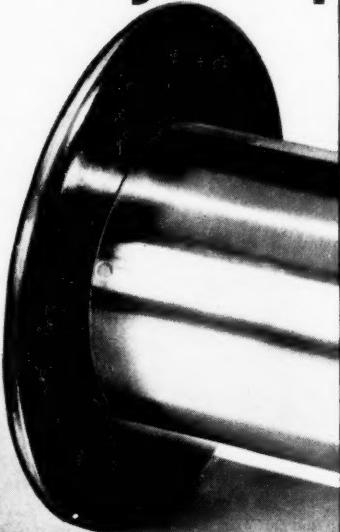
MILLS
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LABORATORY PRESSES

RUBBER AND PLASTIC
MACHINERY DIVISION

EEMCO — ERIE ENGINE & MFG. CO.

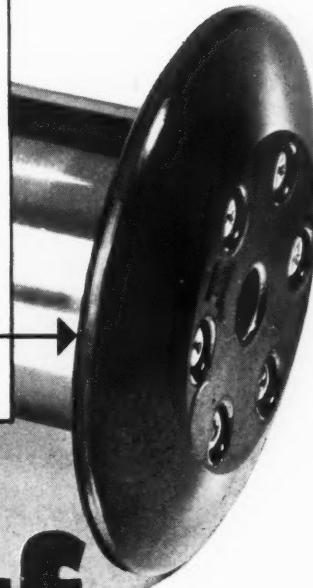
ERIE, PENNA.

Check the qualities you want in your product



- Durability
- Toughness
- Strength
- Lightness
- Abrasion Resistance
- Rigidity
- Impact Resistance

TEXTILE Cable Reeler Spool of light alloy steel with tough, durable ends molded of Plio-Tuf. Akron Spool & Manufacturing Company and their customers find spool ends molded of Plio-Tuf eminently satisfactory after years of hard use.



You get them
all with

Plio-Tuf

TEXTILE spools like this must have all the characteristics listed above. They take a terrific beating in service—have to resist the tremendous force of the "end-thrust" produced by the rapid reeling of thread—the impact of being thrown into carts after being filled. Ends of these spools are now being molded of **Plio-Tuf**—Goodyear's blend of Pliolite S-6 resin and natural or synthetic rubber. One of the largest users of these spools states they are THE BEST HE HAS SEEN IN MANY

YEARS OF MILL EXPERIENCE.

Plio-Tuf brings to a wide range of products the qualities listed here. In addition, it is easily mixed and processed, gives faithful mold reproduction, is easy to machine or buff to a high gloss, and is resistant to water and chemicals. By varying the proportions of resin and rubber, and incorporating various loadings, you can secure a wide range of weights, hardness, rigidity, impact resistance and color with **Plio-Tuf**.

Plio-Tuf can be easily prepared on conventional rubber-mixing machinery, or obtained in an already-mixed master batch. For details and sample, write:

Goodyear Chemical Division
Akron 16, Ohio



Plio-Tuf, Pliolite—T.M.'s The Goodyear Tire & Rubber Company

GOOD YEAR

We think you'll like "THE GREATEST STORY EVER TOLD"—Every Sunday—ABC Network



use—

WHITE TEX

• FINE particle size white pigment.
Brightness 90-92. GOOD reinforcing.
Excellent processing.

»» SAMPLES SENT PROMPTLY ON REQUEST. ««

SOUTHERN CLAYS, Inc.

33 RECTOR STREET
NEW YORK 6, N. Y.



covers the WATERFRONT on water-based latex materials:

- **LOTOL*** Compounded Latices—Ready to use
- **KRALAC*** Plastic Latices
- **NITREX*** Butadiene Acrylonitrile Copolymer Latex
- **SHRINK-MASTER** Process for Rendering Woolens Shrink Resistant and Long Wearing
- **LATEX** Natural and Synthetic
- **KANDAR*** Permanent Finish for Textiles
- **KOLOC*** Cationic Resin Compositions for Cotton, Rayon and Wool
- **NAUGATEX*** Dispersed Chemical Compounding Ingredients for all Latices
- **KRALASTIC** Flexible Plastic Latices
- **DISPERSITE*** Aqueous Dispersion of Rubber, Reclaimed Rubber or Resins

*Registered U. S. Patent Office

Naugatuck Chemical

Division of UNITED STATES RUBBER COMPANY

NAUGATUCK, CONNECTICUT

BRANCHES: Akron • Boston • Charlotte • Chicago • Los Angeles • New York • Philadelphia

Rubber Chemicals • Aromatics • Synthetic Rubber • Plastics • Agricultural Chemicals • Reclaimed Rubber • Latices

SUBLAC

non-scorching
RESIN

a
synonym
for
saving

SUBLAC Resin B-2-A, a white powder, is the lowest priced, non-scorching reinforcing resin available today!

SUBLAC Resin is outstanding in its ability to impart desirable characteristics to rubber compounds. For example, it may be used to obtain any of these properties: Hardness, Stiffness, Abrasion Resistance, Tear Resistance, Oil Resistance. In many cases, the use of **SUBLAC** Resin alone is sufficient to obtain a combination of several of these properties and at the same time provide a compound with easy processing characteristics and a high general order of physicals. *In addition, SUBLAC Resin is non-scorching!*

SUBLAC Resin B-2-A is especially advantageous in stocks highly loaded with clay, whiting, or Silene. The following compounds are representative of such highly loaded, easy processing stocks that require no 'trick' mixing techniques:

Experimental Slab Stock

GR-S 521	100
SUBLAC Resin B-2-A	30
Circo Light	35
ZnO	5
DPG .....	.15
Altax	2.13
Hard Clay	300
Sulfur	3.70

Experimental Tile Stock

GR-S 521	100
SUBLAC Resin B-2-A	30
Circo Light	15
ZnO	5
DPG .....	.5
Altax	2.13
Hard Clay	200
Whiting	150
Sulfur	8

Cure 10' @ 320° F

Tensile	950
Elongation	450%
Shore Hardness (A Scale) ..	97.98

Shore Hardness (D Scale) ..60-61

In these compounds, the **SUBLAC** Resin was added to the rubber, then enough clay to take up all of the oil, followed by the remainder of the ingredients in the usual manner.

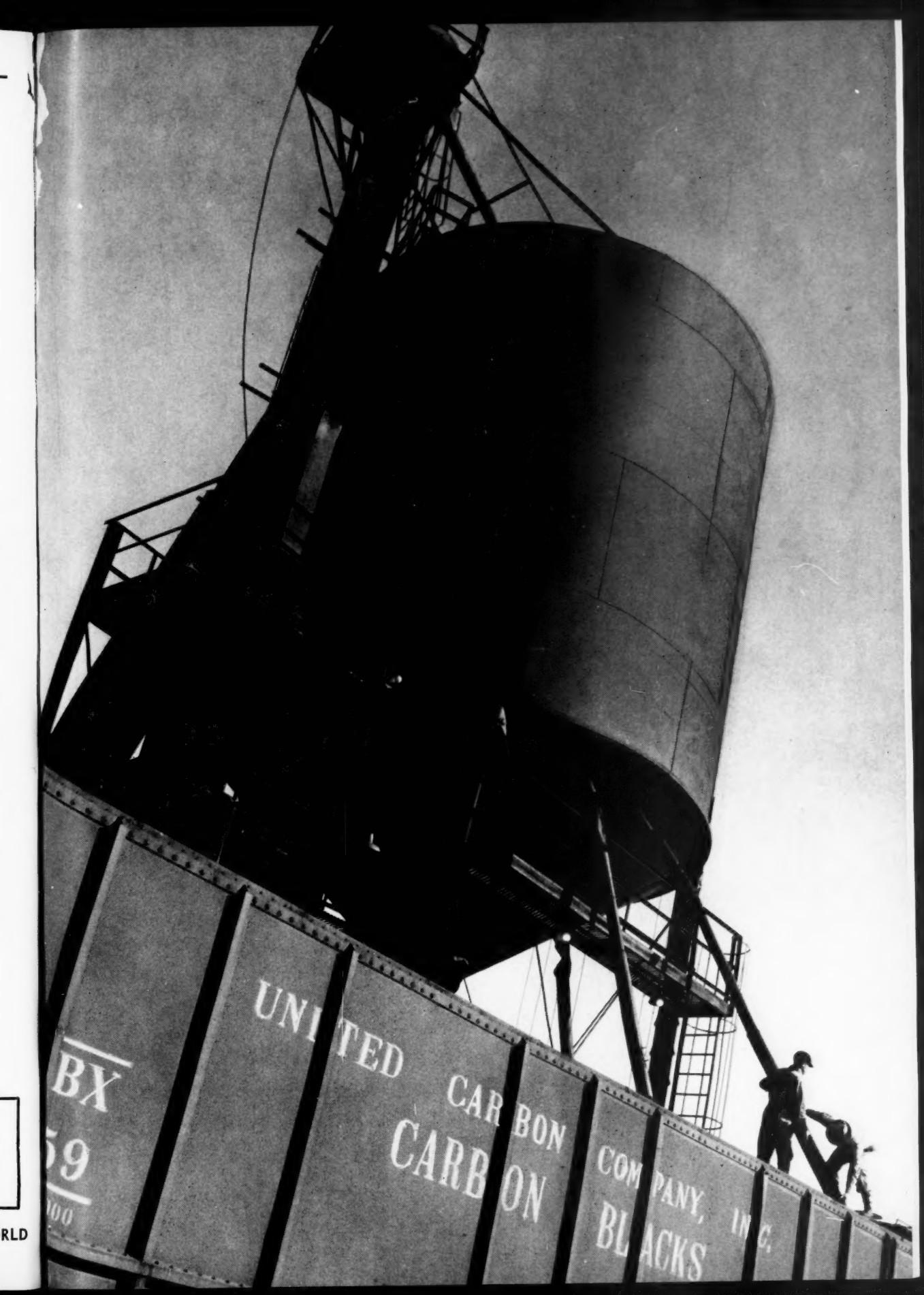
SUBLAC Resin B-2-A is readily available. Send for your sample today!

Prices ..

29½c lb. in truck loads
30c lb. in lesser quantities
fob factory in fiber drums

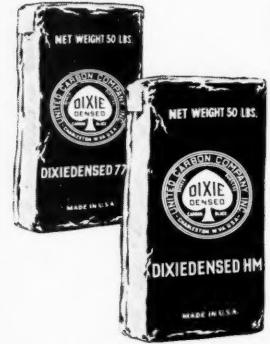
THE POLYMEL CORP.

1800 Bayard Street
Baltimore 30, Maryland
Phone: PLaza 1240



DIXIEDENSED 77 EPC

DIXIEDENSED HM MPC



United channel blacks command attention. They are made with the skill acquired through decades of experience in carbon black manufacture. Their handling qualities are a boon to compounders and operators. Their service performance evokes highest satisfaction.

United channel blacks are standards of quality. They are dependable and uniform. For best results, select United blacks.

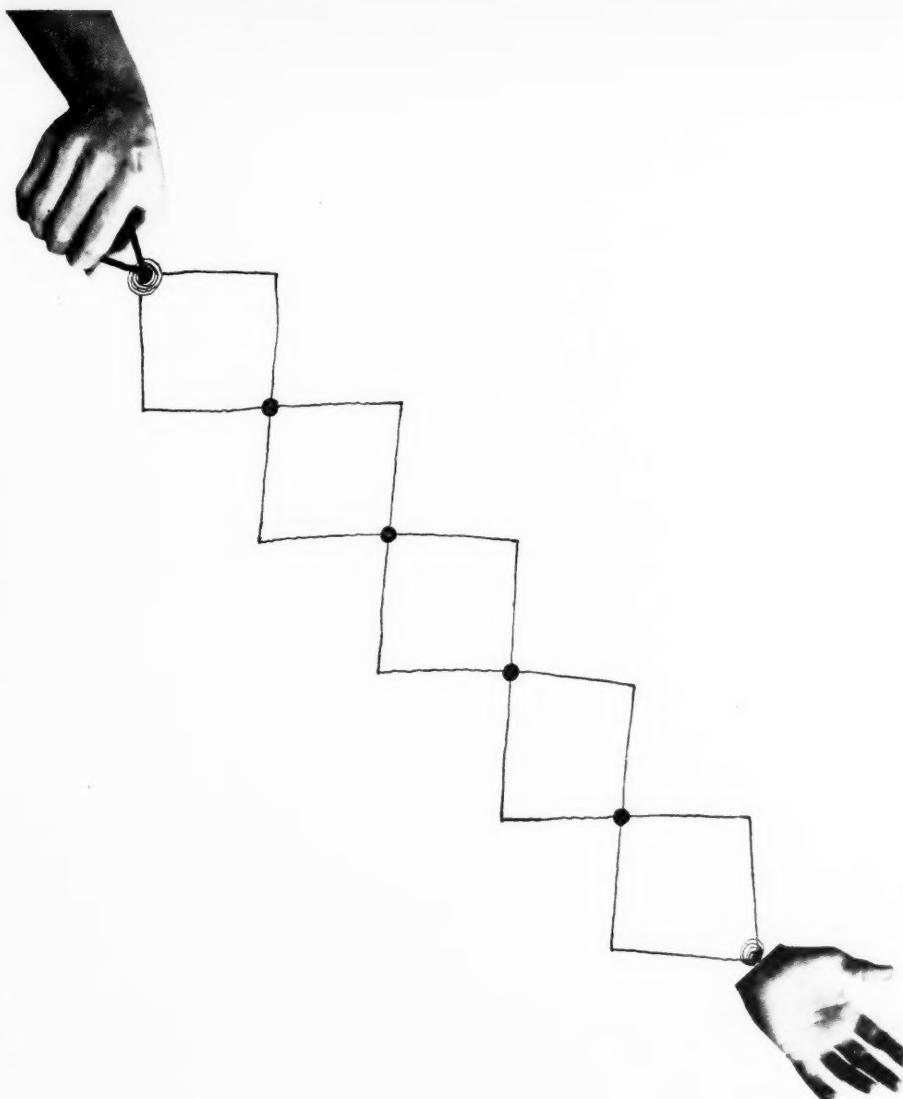


RESEARCH DIVISION

UNITED CARBON COMPANY, INC.

Charleston 27, West Virginia

Febru



you can extend
your crude up to 30%
with Purecal!

Crude rubber is critical and costly.
That's why it makes sense to stretch it with
Purecal*. Purecal U will extend your
crude rubber up to 30%...will improve
tear resistance...will lower costs
over 14% (with no loss in tensile strength
or hardness).

Sound good? Purecal is good!
Purecal M is the only calcium carbonate
pure enough to add to synthetic or
natural lattices without thickening or gelling.
If you'd like to know more write for
our booklet, "Purecal in Natural Rubber."

*Trademark

SODA ASH • CAUSTIC SODA • BICARBONATE OF SODA
CALCIUM CARBONATE • CALCIUM CHLORIDE • CHLORINE
HYDROGEN • DRY ICE • SYNTHETIC DETERGENTS • GLYCOLS
CARBOSE (Sodium CMC) • ETHYLENE DICHLORIDE • PROPYLENE
DICHLORIDE • AROMATIC SULFONIC ACID DERIVATIVES
OTHER ORGANIC AND INORGANIC CHEMICALS

WYANDOTTE CHEMICALS CORPORATION
Wyandotte, Michigan • Offices in Principal Cities



*an \$8,000,000 expansion
program for the production
of ST. JOE lead-free ZINC OXIDES*



AT JOSEPHTOWN, PA., on the south bank of the Ohio River about thirty miles northwest of Pittsburgh, is the electric-thermic smelter, which operates as a custom smelter, receiving both domestic and foreign concentrates. Constructed in 1930, the plant was designed to produce zinc oxide and to process 120 tons per day of zinc concentrate obtained mainly from

the Company's zinc mines in St. Lawrence County, N.Y. Expansion of the plant and equipment during 1939 and 1940 brought the processing capacity to upwards of 300 tons of concentrate per day. As a result of a postwar expansion program completed in 1950, at a cost of about \$8 million, the plant's processing capacity has been doubled.

ST. JOSEPH LEAD COMPANY
250 PARK AVENUE • NEW YORK 17 • ELDORADO 5-3200

Plant & Laboratory, Monaca, (Josephtown), Pennsylvania

demand
COMMAND performance

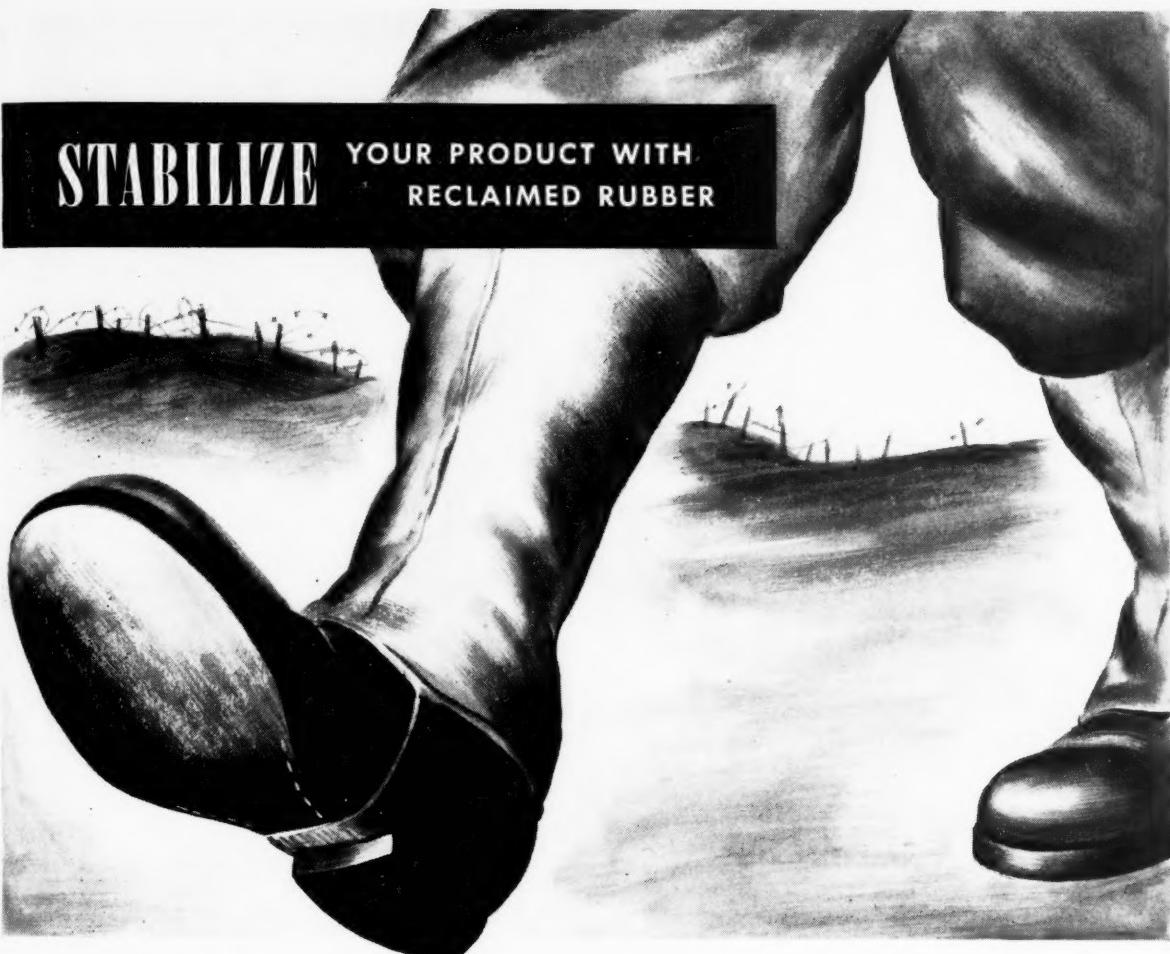
Reproduced here, in miniature, is one of our advertisements which appeared in the trade press early in 1950. The completion of our second expansion program announced therein, resulted in a 500% increase in the smelter's processing capacity since the start of operations in 1930.

These successive increases in our production facilities were necessitated, fundamentally, by one single factor: The consistent high quality of ST. JOE lead-free ZINC OXIDES. The recognition of this factor by zinc oxide consumers resulted in a steadily growing demand for our product from regular customers, plus the additional tonnages of our zinc oxides required by the constantly increasing number of new customers.

Our book ST. JOE ZINC OXIDES, containing fifty-five pages of technical data, is available to Purchasing Agents and Technologists in the ZnO-consuming industries — with our compliments.

ST. JOSEPH LEAD COMPANY
250 PARK AVENUE • NEW YORK 17 • ELDORADO 5-3200

Plant & Laboratory, Monaca, (Josephtown), Pennsylvania



STABILIZE YOUR PRODUCT WITH
RECLAIMED RUBBER

U.S. RECLAIMS help keep the U.S. *Marching Along*

. . . in spite of the shortage of rubber!

Yes, America in action . . . fighting, working or walking consumes a prodigious amount of footwear and, today, a goodly portion of that footwear is made of rubber. Current demand by the Army, Navy and civilian population for millions and millions of pairs of shoes, galoshes and various types of boots has placed a terrific strain on the production facilities of the nation's footwear industry AND — *our normal supply of rubber!* But — once again, reclaimed rubber is successfully filling the gap. Footwear manufacturers are meeting the challenge of this emergency because they learned years ago how profitable and production-wise it was to keep a substantial percentage of U. S. Reclaims in their formulae.

No matter what *you* make out of rubber, be it tires, battery boxes, mechanicals, garden hose or gaskets, you can STABILIZE your quality, your production and your cost by incorporating a U. S. Reclaim in your formula. In addition, you'll find that you'll get faster mixing and easier processing. So, in *your* production plans for the future, remember that U. S. can help you STABILIZE your product and MAKE YOUR NEW RUBBER GO FARTHER.

Always keep reclaims in your formula and always look to U. S. for the best. U. S. Rubber Reclaiming Company, Inc., P. O. Box 365, Buffalo 5, N. Y. Trenton agent: H. M. Royal, Inc., 689 Pennington Ave., Trenton, N. J.



68 years serving the industry solely as reclaimers

RUBBER RECLAMING COMPANY, INC.



"ICEBERG" PIGMENT



"ICEBERG" PIGMENT



**Let BURGESS
Help Solve Your
Color and Mineral
Loading Problems**

Use "ICEBERG"** PIGMENT—

- for butyl wire and insulating compounds
- for colored butyl inner tubes, drug sundries, vinyl compounds, and mechanical goods.

Its properties include:

- Good reinforcing and processing properties
- Excellent white color
- GE Brightness 90-92
- Uniform pH
- Low moisture absorption
- Yields excellent electrical characteristics
- Fine particle size
- Minimizes die plating or ring coating (sticking of resinous mineral material to the die)

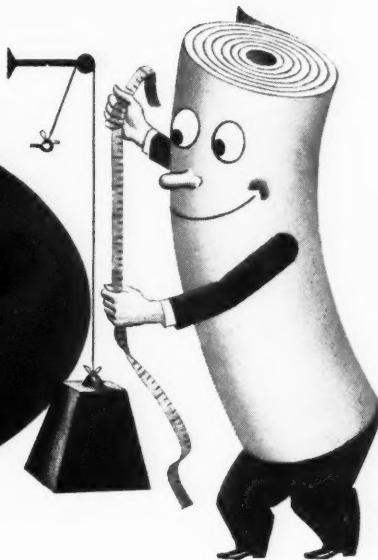
**"ICEBERG" Pigment is Burgess brand of anhydrous kaolin pigment (U.S. Patent 2307239).

Burgess Pigment COMPANY

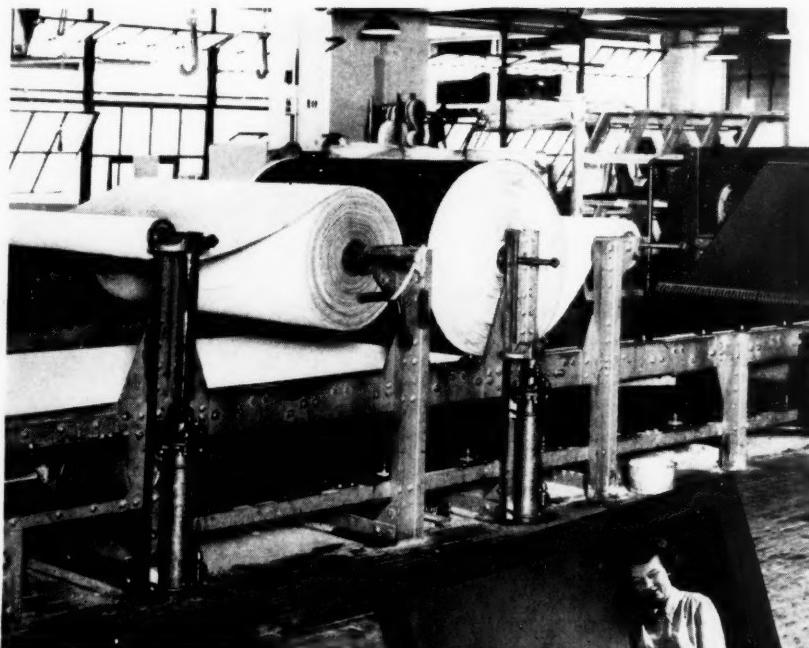
EXECUTIVE SALES OFFICES: 64 HAMILTON ST., PATERSON, N. J. • CHICAGO AREA: WALTER H. HERRS,
40 CUSTER ST., LEMONT, ILL. • WEST COAST: MERIT WESTERN COMPANY, 1248 WHOLESALE ST.,
LOS ANGELES 21, CAL. • MINES AND PLANTS AT SANDERSVILLE, GEORGIA • WAREHOUSES: TRENTON,
NEW JERSEY; AKRON, OHIO; PROVIDENCE, RHODE ISLAND.

HYDROUS AND AN-HYDROUS KAOLIN PIGMENTS • CLAYS • ANTISUN WAX • PLASTICIZERS • WHITINGS • MINERAL COLORS.

UNIFORMITY INDUSTRIAL



Give You Greater Fabric Uniformity



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TURNER HALSEY

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Branch Offices: Chicago • Atlanta • Baltimore
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The greater uniformity
of Mt. Vernon fabrics means
consistent quality in your fin-
ished products — smoother,
more efficient fabrication.

AT YOUR SERVICE

Mt. Vernon-Woodberry's staff of
textile engineers is available on
request to help you with your prob-
lems in development or application
of industrial fabrics.

*Woodberry
Mills*

*Indispensable TO YOU
IN THE RUBBER
INDUSTRY—*



Gives Your Products

**PROTECTION and SALES APPEAL
at Little Cost!**

BEACOFINISH—a unique family of coating materials conceived to give your products greater durability and eye appeal. These highly concentrated wax emulsions that can be diluted with up to four parts of water can be used with the utmost safety and economy.

BEACOFINISH is therefore of four-fold importance to you:—

1. **It Protects** your products against their natural enemies—air, sunlight, moisture and excessive handling.
2. **It Improves** the appearance of your product for its uniform coating stimulates greater consumer interest.
3. **It's Economical** because its high dilution potential (without losing efficiency) allows one gallon to cover 15,000 sq. ft.
4. **It's Safe** being a wax in water emulsion, it eliminates the fire and health hazards of volatile-solvent based finishes.

BEACOFINISH can be applied by dipping, sponging, spraying or brushing—dries in about 20 minutes—faster if force-dried—to give a hard protective coating of great elasticity.

BEACOFINISH may be ordered in Neutral or Black, in varying degrees of luster from brilliant to dull. It is so concentrated, from one drum you can obtain potentially up to five drums of superior coating for your products.

CONSULT US—WRITE US TODAY

Let us show you how **BEACOFINISH** can make your products more attractive and saleable—protect them from damage—you from loss—in production and transit!

THE
BEACON



COMPANY
*Chemical
Manufacturers*

97 BICKFORD STREET
BOSTON 30, MASSACHUSETTS

In Canada: PRESCOTT & CO., Reg'd.
774 St. PAUL ST. W., MONTREAL



Source of bright, colorful **VINYL UPHOLSTERY**

Increased consumer acceptance of supported and unsupported vinyl upholstery attests the desirability of attractive whites and soft pastels.

In vinyl upholstery TITANOX rutile or anatase titanium dioxides impart exceptional whiteness, brightness and opacity, and their compatibility with all types of synthetic or natural polymers helps maintain natural strength.

TITANOX-A, anatase type, is suggested where whiteness is of paramount interest. TITANOX-RA—the rutile type—is recommended for outstanding whiteness at low loadings. In heavily loaded stocks and in many tints, where the tinting strength of the pure oxides is not required, the rutile-calcium pigment—TITANOX-RCHT—may be used. All TITANOX pigments maintain bright, clean tints and their fine and uniform particle

size affords easy mixing and grinding for complete dispersion throughout the polymer.

Our Technical Service Department is always available to help you with your problems in pigmenting all types of natural or synthetic polymers. Titanium Pigment Corporation, 111 Broadway, New York 6, N.Y.; Boston 6; Chicago 3; Cleveland 15; Los Angeles 22; Philadelphia 3; Pittsburgh 12; Portland 9, Ore.; San Francisco 7. In Canada: Canadian Titanium Pigments, Ltd., Montreal 2; Toronto 1.

8888

®

T I T A N O X

the brightest name in pigments



T I T A N I U M P I G M E N T C O R P O R A T I O N
Subsidiary of NATIONAL LEAD COMPANY

Chemicals you live by

2

MONEYMAKERS...

FOR VINYL COMPOUNDING

Chlorowax 40* and Surfex* can be used separately or in combination to lower vinyl compounding costs and increase batch yields with no sacrifice in quality. Chlorowax 40 is DIAMOND ALKALI's liquid chlorinated paraffin which has proved highly satisfactory as a low-cost co-plasticizer. Surfex is one of DIAMOND's precipitated calcium carbonates—a reagent extender of high uniformity and purity.

The table indicates how these two DIAMOND chemicals may be applied in vinyl compounding to produce two-way savings. Specific formulas are available through your nearest DIAMOND Sales Office.

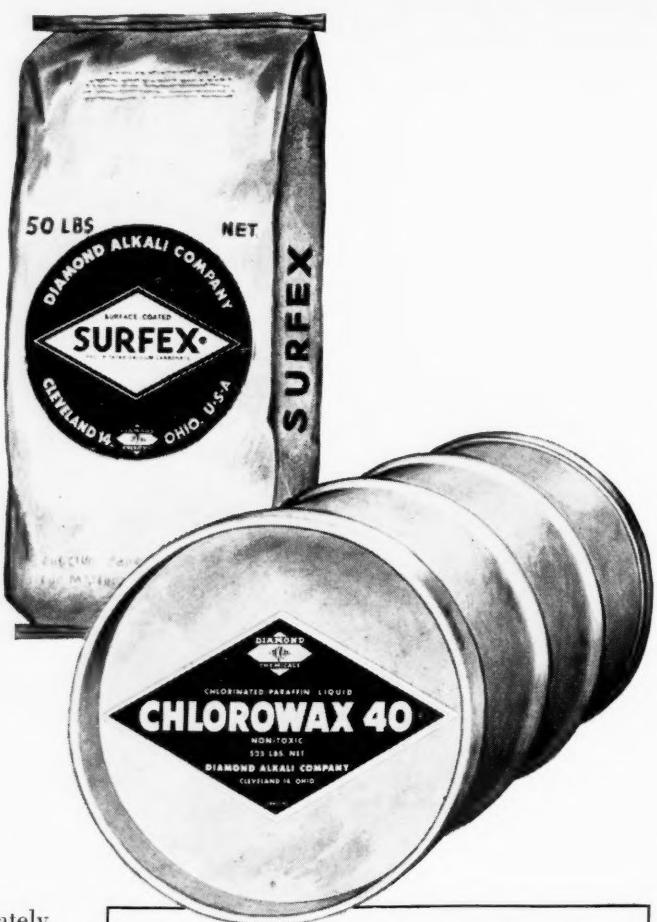
*®

DIAMOND SALES OFFICES: New York, Philadelphia, Pittsburgh, Cleveland, Cincinnati, Chicago, St. Louis, Memphis and Houston. Also representatives in other principal cities.

DIAMOND CHLOROWAX 40 AND SURFEX

DIAMOND ALKALI COMPANY...CLEVELAND 14, OHIO

PARTS		
PVC RESIN	100	100
PRIMARY PLASTICIZER	52	47
CHLOROWAX 40*	—	15
STABILIZER	3	3
STABILIZER—LUBRICANT	0.5	0.5
SURFEX*	—	15
TOTAL	155.5	180.5
ESTIMATED MATERIAL COST		
LB./VOL.	45.8¢	41.6¢
YIELD—% INCREASE PER LB. OF RESIN	(11 By Vol.)	
HARDNESS	85A	85A
TENSILE STRENGTH	2600 psi	2600 psi
ELONGATION	375%	375%
100% MODULUS	1400 psi	1400 psi
CRESCENT TEAR	375 lbs./in.	375 lbs./in.
BRITTLENESS—TEMPERATURE	-31°C	-29°C
HEAT LOSS	5.5%	4.7%



DIAMOND
ALKALI
CHEMICALS

INDIA RUBBER WORLD

THE "SPECIAL" MILL YOU ARE DREAMING ABOUT

In a century of building processing machinery, Farrel-Birmingham has designed mills for almost every conceivable application. This means that, ordinarily, *any mill needed* can be furnished from existing drawings and patterns. However, if the equipment you require really is special, Farrel-Birmingham is prepared to engineer a mill with any combination of design features and attachments necessary to fill your needs.

The basic design and construction of Farrel-Birmingham mills have been thoroughly tested for many years by thousands of successful installations for a variety of applications. A steady progression of improvements has brought them to their present-day point of high efficiency and refinement of design.

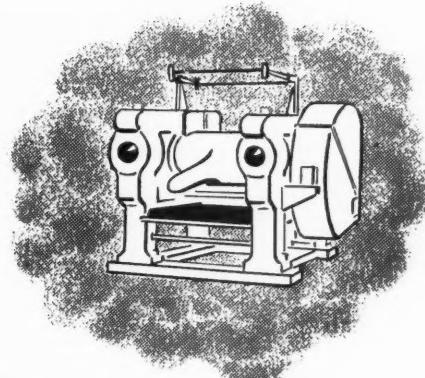
For further details of Farrel-Birmingham mills, send for a copy of Bulletin 173. No cost or obligation.

FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONNECTICUT

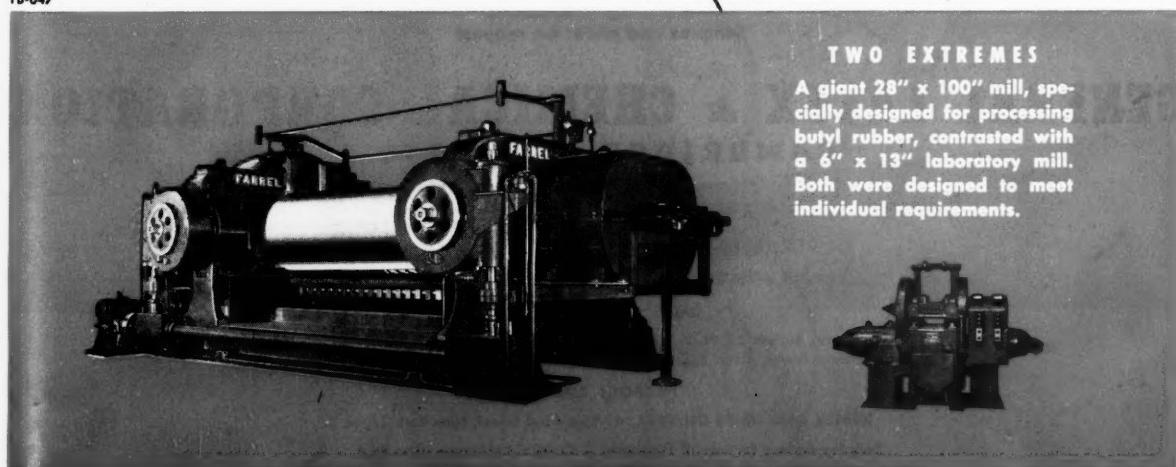
Plants: Ansonia and Derby, Conn., Buffalo, N. Y. Sales Offices: Ansonia, Buffalo, New York, Akron, Chicago, Los Angeles, Houston

Farrel-Birmingham®

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FB-647



TWO EXTREMES

A giant 28" x 100" mill, specially designed for processing butyl rubber, contrasted with a 6" x 13" laboratory mill. Both were designed to meet individual requirements.

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WIDE RANGE OF SOLIDS • GOOD AGING • LOW MODULUS**

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General Latex has available several Buna N latices and can supply them un compounded, or compounded to emphasize the particular physical properties essential to your product.

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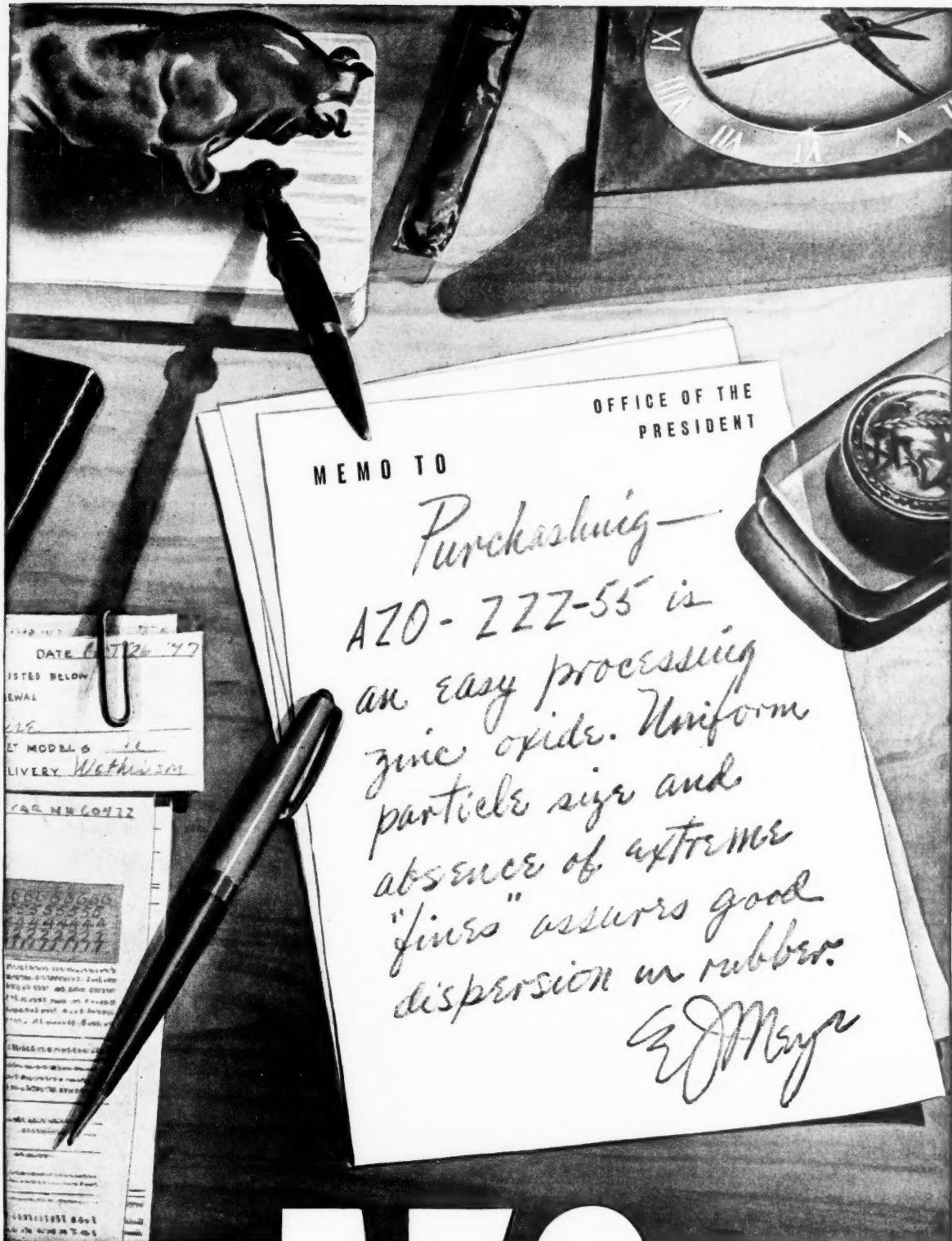
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RUBBER & PLASTICS MACHINERY BULLETIN

Reporting News and Machine Design Developments

IN BUSINESS TO



REDUCE YOUR COSTS

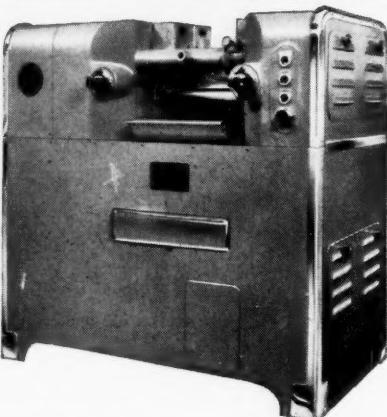
CHANGE MILL GUIDES ON NRM LABORATORY MILL IN 3 MINUTES

On NRM's Model 48 Laboratory Mill, stainless steel mill guides of advanced design permit change in set-ups, or replacement for cleaning, in three minutes or less.

Such attention to the research man's problems is inherent in NRM mills, which have been designed in cooperation with leading industrial research laboratories and government and university laboratories.

NRM mills are available with roll diameters of 4", 6", or 10", for roll lengths of 9", 12", or 20". The forged steel rolls are mounted in tapered roller bearings. Leakproof pressure joints with internal piping eliminate the need for packing.

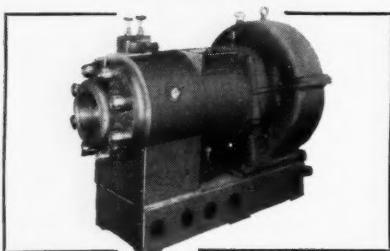
The mills are fully enclosed, suitable for use on high-temperature milling. A



knee safety stop and a plugging safety stop are provided.

NRM's line of laboratory mills, calenders, washers, tubing machines and allied equipment provide tools for sound, accurate research. For full information, write National Rubber Machinery Company, 47 West Exchange Street, Akron 8, Ohio.

Accessibility Feature of New NRM Tubers



This NRM Model 50, 8"-diameter screw machine is the first of a new line of NRM extruders designed for easy access to parts and neat appearance.

Drain valves are externally mounted

and can be operated easily. A sump in the bottom of the cylinder jacket permits easy removal of sludge, preventing loss of efficiency in heating or cooling. The unit is equipped with a flanged liner which can be readily removed. Pockets which might collect dust and dirt have been eliminated.

30 per cent additional thrust capacity is provided in the drive. Heavy-duty herringbone gears are used. For additional information write National Rubber Machinery Company, 47 West Exchange Street, Akron 8, Ohio.

NEW NRM TWO-STAGE EXTRUDER ELIMINATES INITIAL COMPOUNDING AND DRYING

Another NRM "first" to further simplify extruding operations . . . to save on production time . . . to cut your manufacturing costs. Once again the pioneer in its field, the new NRM Two-Stage Extruder introduces a new development for drying and extruding pre-blended wet acetate acrylic and polystyrene compounds to be pelletized direct at the die or in a chopper.

By eliminating the need for initial compounding and drying, it now becomes possible for any plant to mix its own compounds to customer's specifications and at lower cost. In addition, less expense is involved for maintenance and labor formerly needed to operate more expensive equipment.

Premium costs of specially mixed short orders are no longer necessary. Compounds can be quickly made from a simplified inventory of basic materials such as resins, plasticizers, stabilizers, fillers and dies.

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The first single screw extruder to incorporate colloidizing, devolatilizing and extruding, this new development is similar in design and operation to standard NRM plastic extruders. Existing NRM extruders now operating in the field can be modified to incorporate the many time and cost saving features of the new NRM Two-Stage machine. For complete details, simply write Plastics Machinery Division, National Rubber Machinery Company, Akron 8, Ohio.

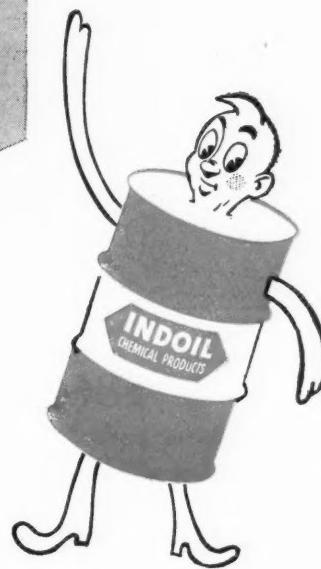
NATIONAL RUBBER MACHINERY CO.

General Offices & Engineering Laboratories
Akron 8, Ohio

PLANTS at Akron and Columbiana, Ohio and Clifton, N. J.
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with increased fillers or extenders can help maintain production without loss of quality.

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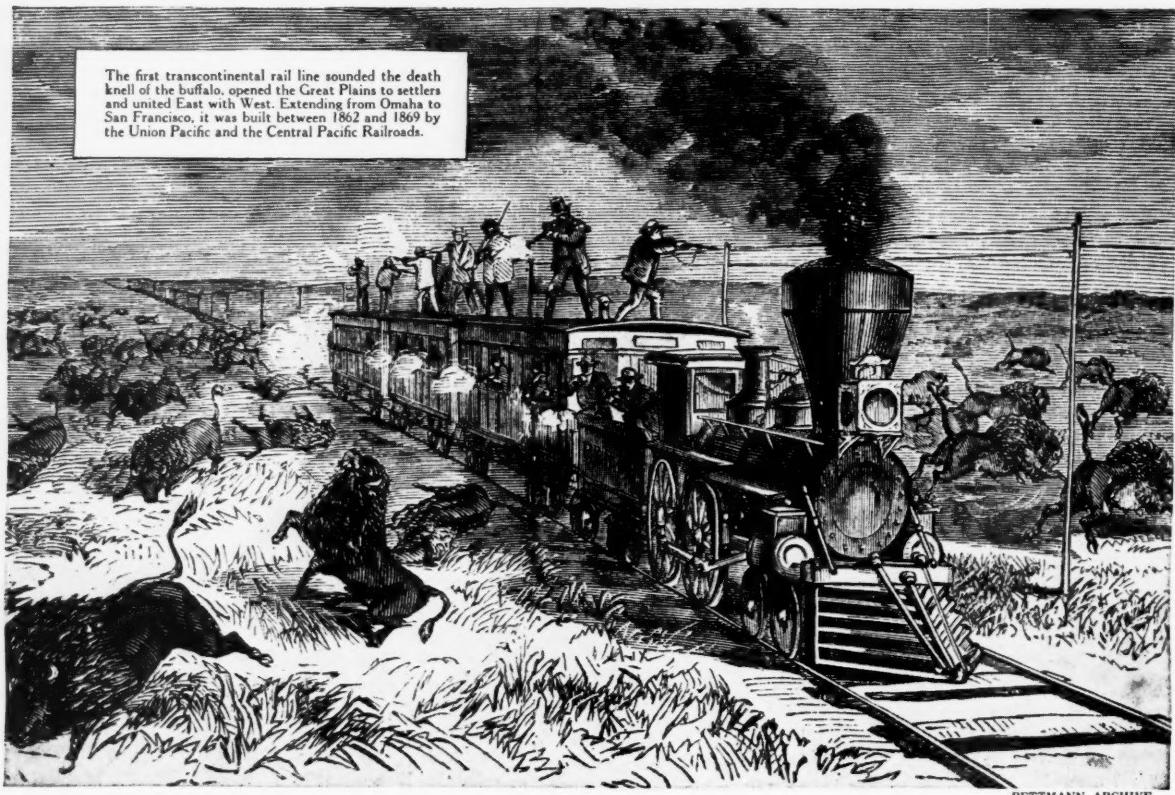


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*Are you concerned about catalytic metals in your compounds? INDONEX shows less than one part per million of copper or manganese by spectrographic analysis.

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So, since 1865, Horse Head Zinc has spurred the growth of industrial America.

For over a century, The New Jersey Zinc Co. has continued to pioneer outstanding developments, many of which have helped speed the progress of the rubber industry.

HORSE HEAD ZINC PIGMENTS *The Pioneer Line*

Most used by the rubber industry since 1852

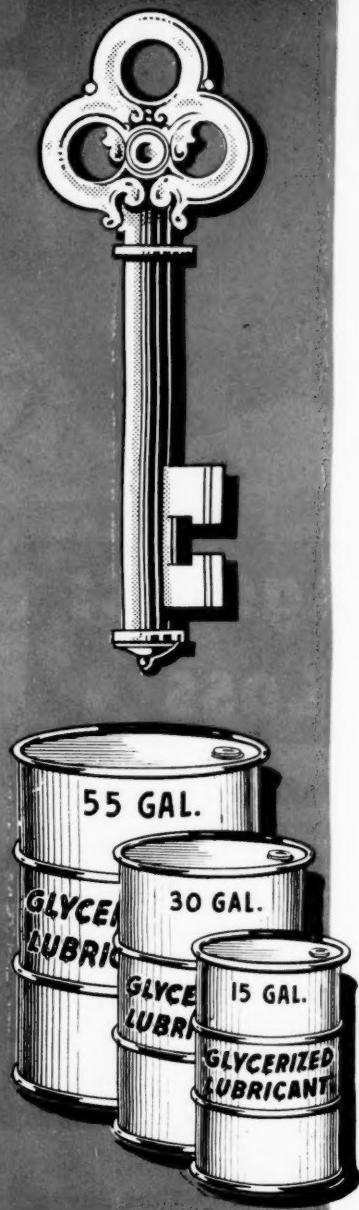


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Founded 1848

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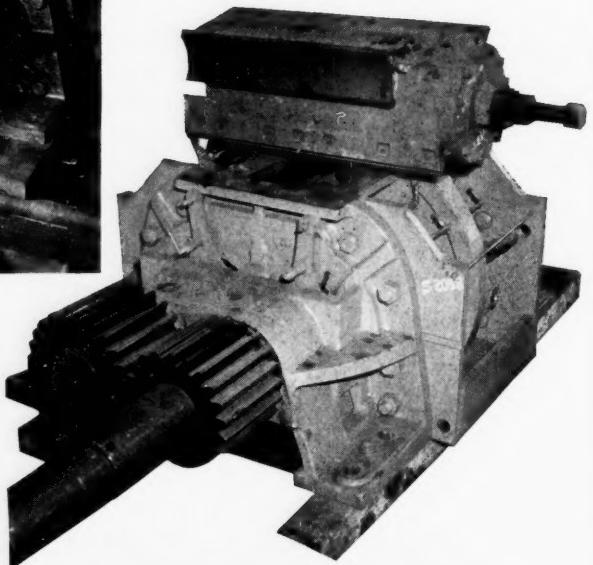
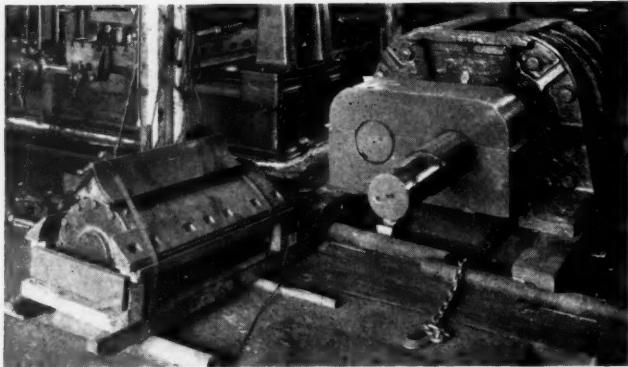
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Call or wire us for estimates—for action—Time saved is vital these days—and is money earned for you.

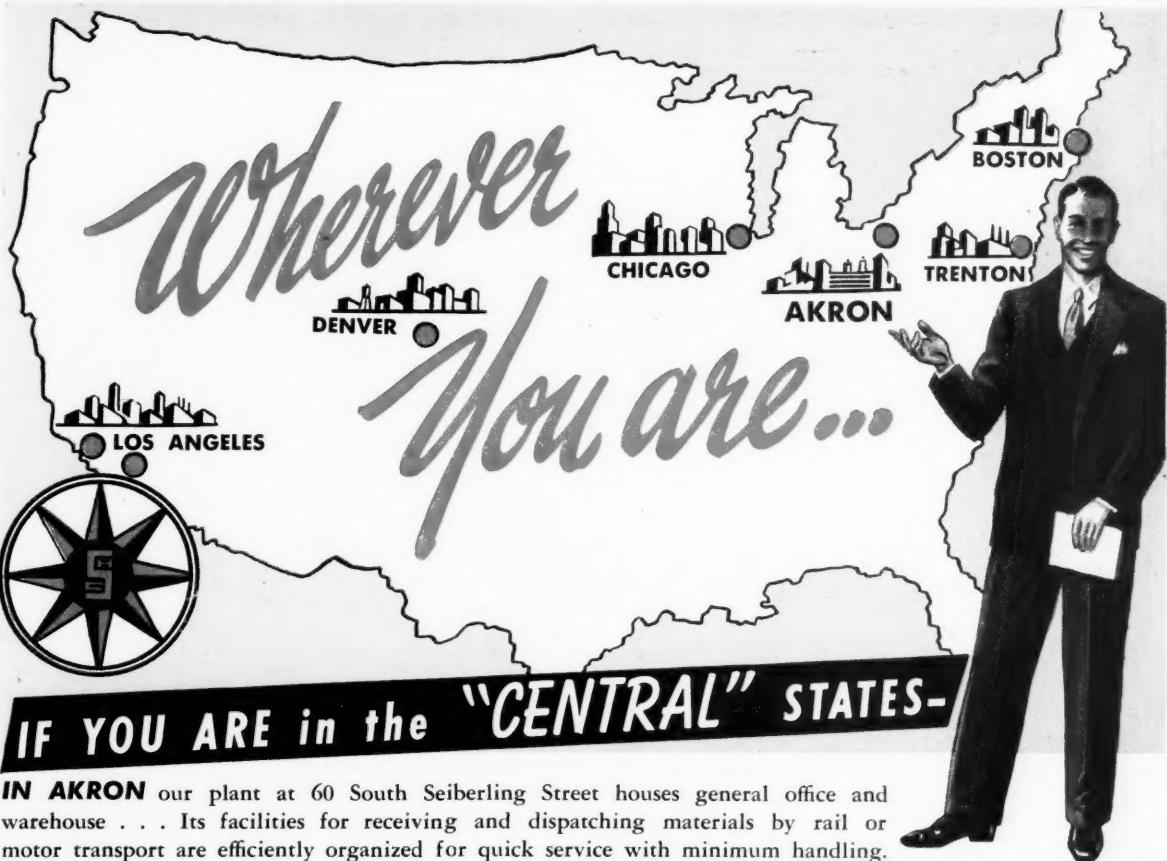
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GEO. E. GRIFFIN, Technical Sales Representative, was trained in chemistry. He was a member of the consulting technical committee of the War Production Board and has had vast experience in rubber and plastics compounding and development.



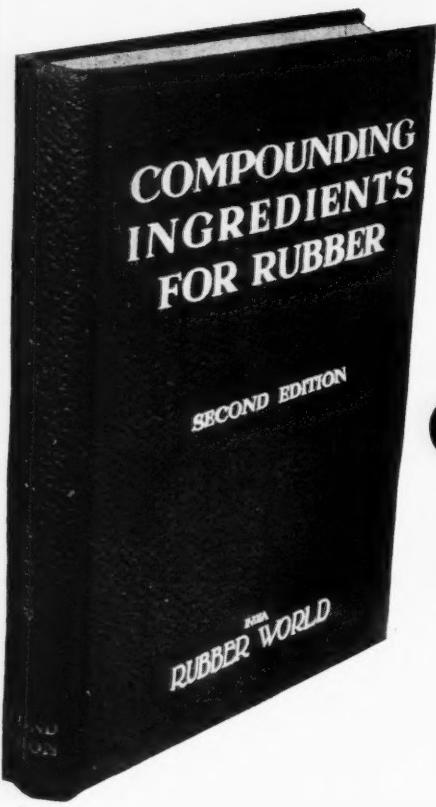
JOHN W. SHRONTZ, Technical Sales Representative, is a graduate chemist with a background of experience in factory and laboratory on compound development of rubber and plastics.

Key men in the General offices at Akron have been selected for both experience and training in the sales and applications of materials handled by the Harwick organization . . . And in the administration details where procurement and delivery to meet important schedules is a service "must" today. Technical sales representatives, headquartered in the Akron office, are picked men of special training in chemical engineering and with years of experience in factory compounding and production . . . They can help you in many ways to meet some of today's production problems.

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FOR EVERY COMPOUNDER

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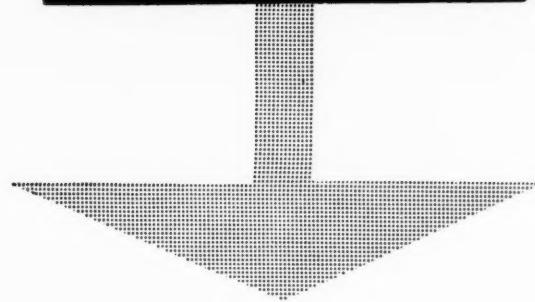
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You will obtain high tensile strength and modulus, excellent tear and abrasion resistance and low compression set.

Write for information and prices.

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NEVILLE

PITTSBURGH 25, PA.

Plants at Neville Island, Pa., and Anaheim, Cal.

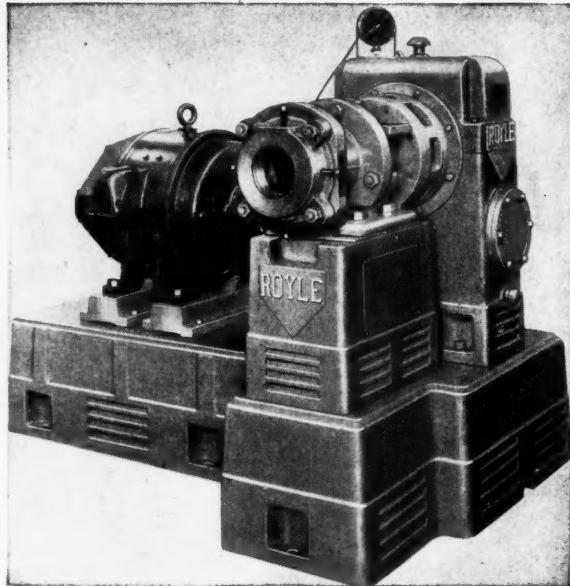
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Designed To Extrude RUBBER or PLASTICS

In these days of rapidly changing developments owners of Royle extruding machines are in the advantageous position of being able to adapt their extruders to either rubber or plastics production. If you are faced with the problem of extruding rubber and plastics the versatility of ROYLE extruders is of paramount importance to you. Whether you require a light or heavy production extruder features have been incorporated to assure maximum results. The change-over is quickly and simply accomplished.

Send for your copy of Bulletin No. 448. It describes these features and how they may be applied to older type extruders.

ROYLE # 2 Extruding Machine.
Non-extended cylinder, plain tubing head.



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means { **TOP quality**
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they EXTEND and TACKIFY
all TYPES of LIQUID LATTICES
SYNTHETIC or NATURAL (LATEX)
(G. R. S.-NEOPRENE-NATURAL)

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they are used to replace a high percentage of the rubber content in Latex Cements, thus lowering costs.

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ACCELERATOR for many kinds of compounds... **EL SIXTY**

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El Sixty (Di [benzothiazyl thiomethyl] urea) offers these advantages:

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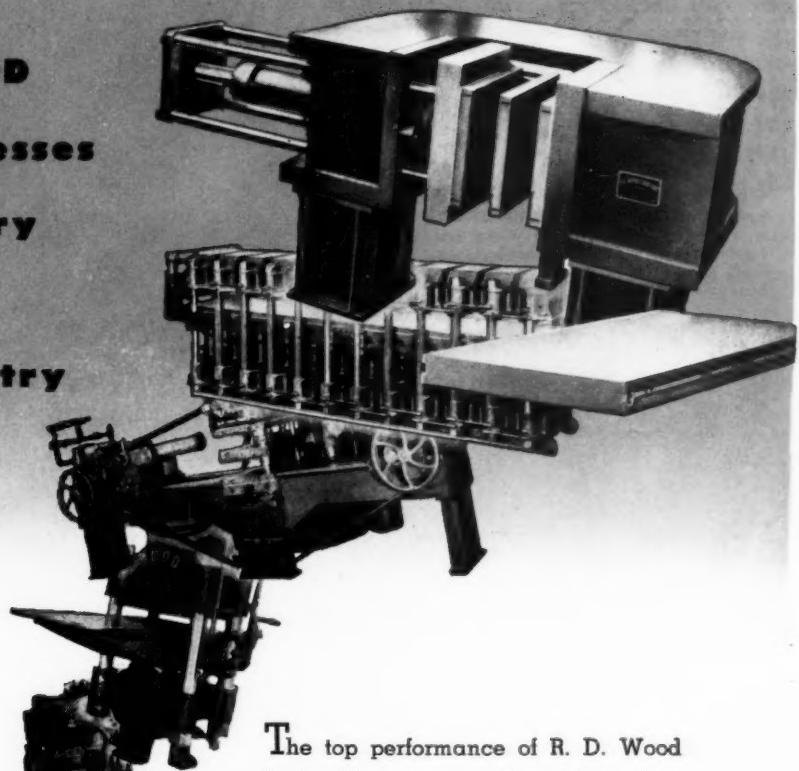
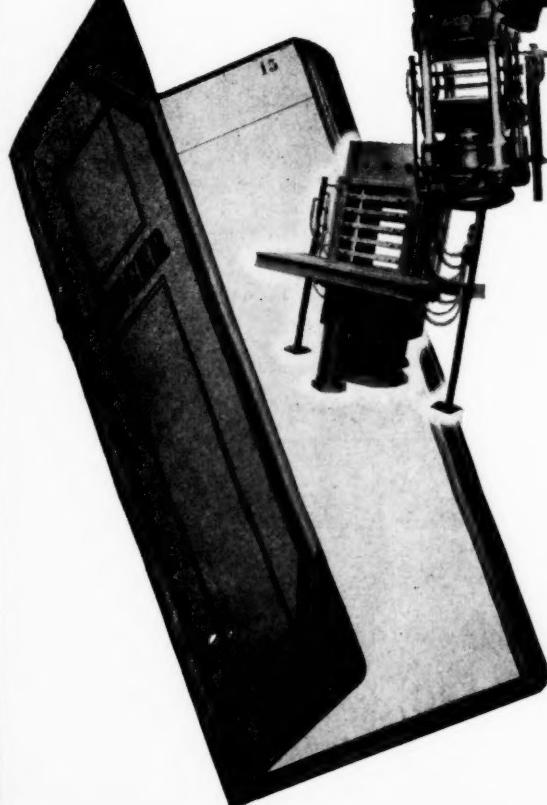
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Latex and Latex Compounds
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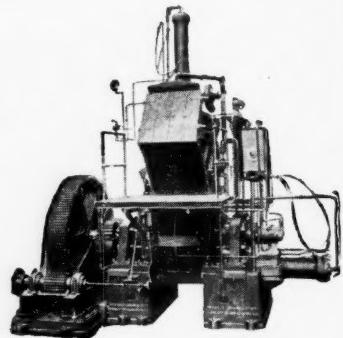
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When an experienced rubber engineer looks at a SHAW Machine, he can see at a glance that there are many advanced features which contribute to high production of first-class goods. But after long usage he will know that it is equally notable for trouble-free operation with low maintenance costs.

SHAW

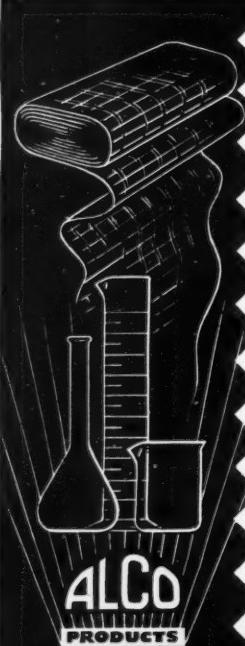


* The machine illustrated is the well-known Shaw Intermix

FRANCIS SHAW & COMPANY LIMITED, MANCHESTER II, ENGLAND

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R196



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February, 1951

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There is an Osborn brush for every maintenance job

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CHEMICALS**
**proven in the
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industry**

★**RESORCINOL** is used for preparation of adhesives that assure a strong bond between rubber and fabric or cords. Koppers Resorcinol used in pre-dip treatment produces excellent bonding of rubber to cotton, rayon and nylon fabrics.

★**DI-tert-BUTYL-para-CRESOL** has wide application as an antioxidant in white rubber products. It retards cracking, checking, hardening or loss of strength without discoloring the product or staining materials with which the product comes in contact.

★**STYRENE MONOMER** polymerizes with active olefinic compounds to produce GR-S type synthetic rubbers.

★**DI-tert-BUTYL-meta-CRESOL** is suggested for use in the preparation of hard rubber or ebonite from GR-N synthetic rubbers. It is reported to improve tensile strength of ebonite and increase tackiness of the stock. Sulfides of DBMC have been reported to be effective peptizing agents for reclaiming of GR-S type synthetic rubbers.

★**MONO-tert-BUTYL-meta-CRESOL** has been reported to be an effective anti-flex cracking agent in rubber and rubber-like materials. And the resin obtained by condensation of MBMC with formaldehyde has been shown to impart tack to GR-S rubber.



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For further information on any of the above chemicals, write for the Technical Bulletin on the chemical(s) in which you are interested. Please address: Koppers Company, Inc., Chemical Division, Dept. IR-2, Pittsburgh 19, Pa.

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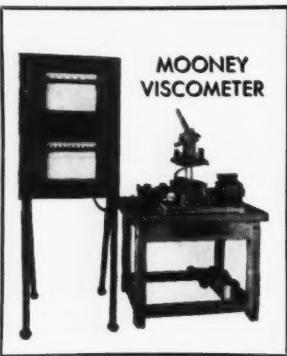
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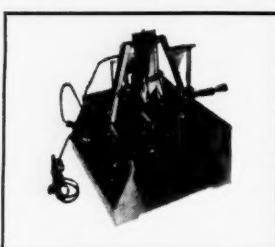
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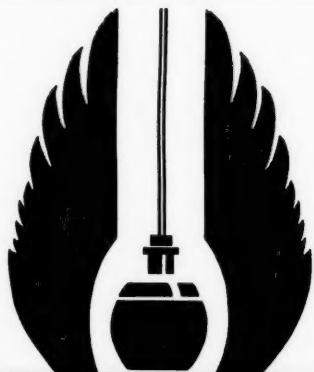
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Vol. 123—No. 5

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FEBRUARY, 1951

Deresination as a Means of Improving the Quality of Guayule Rubber

IN VIEW of the current world situation and its possible effect on this country's natural rubber supply this article, which describes experimental procedures for deresinating guayule shrub with acetone, should be of special interest. Removal of 65 to 70% of the shrub resin effected a reduction of 90% or more of the resin normally present in the crude guayule rubber. The quality of the rubber approached that of *Hevea* smoked sheet, as indicated by stress-strain physical test data. Further comparative evaluation of the guayule rubber produced by this process is being made and will be reported later.—EDITOR.

A N EXPERIMENTAL method for deresinating guayule shrub has been developed by the U. S. Natural Rubber Research Station at Salinas, Calif. The rubber obtained from such deresinated shrub has excellent physical qualities. This work was undertaken as part of a research program to develop guayule so that it might serve as a domestic source of natural rubber should our supply of *Hevea* from the Far East be lost.

Guayule (*Parthenium argentatum*, Gray) is a semi-desert, profusely branching shrub which attains a height of somewhat less than two feet. It contains no organized latex system, as in the case of *Hevea* or other rubber-bearing trees. Rubber occurs in guayule in latex form, but it is confined to individual latex-bearing cells. All parts of the shrub contain rubber, but the main concentration is in the bark of the stems and roots, with only a negligible amount, so far as commercial recovery is concerned, in the leaves. Resins, or acetone soluble constituents, are more evenly distributed throughout the shrub and occur principally in resin ducts. The pattern of rubber and resin distribution, as shown by microscopical examination, has been described in detail (1).³ The distribution of resins and rubber, as shown by chemical analyses, have also been reported (2).

Crude rubber, as obtained by conventional processing of the guayule shrub, contains approximately 20 to 25% resin. In general, the higher the content of resin the

I. Shrub Deresination

Ralph L. Chubb,¹ Eleanor C. Taylor,² and Irvin C. Feustel¹

poorer the physical properties of both the crude and vulcanized rubbers. The content of resin varies with variety and age of shrub, season of harvest, pretreatment of shrub, and other factors. This condition results in a lack of uniformity of commercially produced guayule which limits acceptability and usefulness for many industrial applications.

Infrared examination (3) has indicated that the molecular configuration of the guayule rubber hydrocarbon is the same as that of *Hevea* rubber, both being cis-isomer of polyisoprene. Although average molecular weights and molecular weight distribution within the hydrocarbon may be different in the two rubbers, it was believed that by removal of the resins rubber comparable to *Hevea* in most physical aspects might be produced.

Because of the great improvement in quality and uniformity that is obtained by elimination of most of the resin ordinarily present in guayule rubber, efforts have been directed toward the development of effective means of deresination.

Review of Previous Work

Patent literature (4) describes various processes for deresination of crude resinous guayule rubber as recov-

¹ United States Natural Rubber Research Station, Bureau of Agricultural and Industrial Chemistry, Agricultural Research Administration, United States Department of Agriculture, Salinas, Cal.

² Detailed from Bureau of Plant Industry, Soils & Agricultural Engineering, United States Natural Rubber Research Station, Salinas.

³ Numbers in parentheses refer to Bibliography items at end of article.

ered from the conventional pebble milling process. Other patents (5-6) pertain to deresination of whole shrub to eliminate the resins prior to pebble milling. The latter is known as shrub deresination to distinguish it from rubber deresination. Data presented by Tint and Murray (5) indicate that the tensile strength and other properties of rubber obtained from deresinated shrub were very similar to those of a sample of Honduras smoked sheet used for comparison.

Hauser and le Beau (7) investigated the deresination of commercial resinous guayule rubber containing 26% resin. Extractions were made in a Soxhlet apparatus with various solvents at their respective boiling points. Furfural was shown to be the most efficient solvent with respect to rate of extraction and total amount of resin extracted under the conditions used.

Nishimura *et al.* (8) demonstrated the possibility of using glacial acetic acid for deresination of resinous rubber in the form of thin dried sheets. The acetic acid was claimed to have removed presumably deteriorative substances as well as resin.

The reduction of resin in the crude rubber by micro-biological action or retting of shrub as a pretreatment to pebble milling, has also been investigated (9). This process results in a substantial reduction of resin and quality improvement in the crude rubber. The retting process, however, cannot be expected to yield a crude rubber of less than about half its normal resin content.

Unpublished information in the files of the U. S. National Rubber Research Station reveals that numerous efforts have been made in connection with the commercial production of guayule to produce a deresinated product from the crude resinous rubber. The superiority of deresinated rubber was demonstrated, but products of varying quality and residual resin content were obtained. Extraction of resinous rubber was usually found difficult because of the relative impermeability of the rubber to the resin solvent and the tendency of the rubber particles to stick or lump together, which caused difficulties in handling during and after extraction. Also, some of the very small-sized particles floated and were carried away in the miscella and were lost with the resins in the solvent extract. In most cases the resinous rubber was in a degraded condition to begin with, and the improvement obtained by deresination did not indicate the inherent quality of guayule rubber of low resin content.

Work now in progress in this laboratory indicates that a very high-quality rubber can be obtained by either shrub or rubber deresination if the entire process, beginning at the time of harvest of the shrub and extending through drying of the deresinated rubber, is properly controlled. Rubber deresination, as an alternative process to shrub deresination, will be the subject of a subsequent paper.

Deresination Investigations

Methods of Analysis

Resin in plant material is determined by a modification of the Spence-Caldwell procedure (10). Essentially, this consists of an exhaustive acetone or alcohol extraction following an initial water extraction of the sample. The acetone or alcohol solution of resin is evaporated, then dried to constant weight in a vacuum oven at 65° C. The percentage of resin is calculated on the basis of the dry weight of the plant material.

Resin in crude rubber is determined by an ASTM method (11) in which the sample is cut into very small pieces with scissors and extracted with acetone or alco-

hol. Calculations are made in the same manner as for plant material.

Somewhat different values for resin content of shrub and rubber samples are obtained, depending upon the choice of resin solvent. It was found that the shrub contains more ethanol-soluble than acetone-soluble material, but that the corresponding rubbers have either about the same or slightly lower values for ethanol solubles. The results are shown in Table I. These findings are not surprising since the resin is known to comprise a mixture of many different constituents and cannot be considered as a definite chemical entity. They emphasize, however, the necessity of carefully standardized procedures of analysis to assure comparable values.

TABLE I. RESIN IN SHRUB AND CRUDE RUBBER AS DETERMINED BY ACETONE AND ETHANOL EXTRACTION

Material	Number of Samples Analyzed	Resin Content by Acetone Extraction		Number of Samples Analyzed	Resin Content by Ethanol Extraction	
		Mean	Standard Deviation		Mean	Standard Deviation
Fresh shrub	28	6.9	±0.4	9	8.5	±0.5
Deresinated shrub	33	2.0	±0.3	9	3.5	±0.6
Crude rubber from fresh shrub	23	22.4	±1.6	18	20.7	±2.1
Crude rubber from deresinated shrub	31	1.8	±0.5	5	1.8	±0.7

Shrub was extracted with acetone in connection with laboratory and semi-pilot-plant-scale deresination experiments.

Preliminary Experiments

The work on shrub deresination at this laboratory was begun early in 1945 as a part of the Emergency Rubber Project. One extraction was made by treating lush (freshly harvested) three-year-old shrub with three successive batches of acetone in a 20-gallon stockpot at room temperature. The shrub had first been defoliated by parboiling and trammeling, followed by cutting and crushing. After acetone extraction the shrub was milled in a paper-making jordan to recover the rubber. The crude rubber contained only 3% resin as compared with the normal 20 to 25%, and had markedly superior physical properties.

Later, in 1946, several deresination runs were made using 10-foot lengths of five-inch conductor pipe held in a vertical position as extraction tubes. A liquid-tight fitting was constructed for the bottom of each tube to hold the contents of the tube and to permit withdrawal of solution at will. Five kilograms, dry weight basis, of defoliated, cut, and crushed freshly harvested shrub were placed into each tube. Acetone was allowed to run in slowly at the top and was retained in the tube until the shrub was completely covered. Miscella was then withdrawn as fast as solvent was added. Extraction was continued until practically completed, as indicated by the relative lightness in color of the miscella. Total contact time was about three hours. In these experiments the resin content of the shrub was reduced from 7% to 2-3%. The resulting rubber contained 2-4% resin and possessed excellent physical properties.

Ethanol was also used as a resin solvent, but acetone was observed to give a more rapid extraction under these conditions and was, therefore, selected for the conduct of subsequent experiments. Solvents such as furfural requiring elevated temperatures have not been investigated as yet.

Countercurrent Batch Extraction

On the basis of these preliminary investigations an experiment was designed to determine the possible concentration of resin in the miscella in a countercurrent process. The apparatus used consisted of a series of 25 two-quart jars, each provided with a tube leading to the bot-

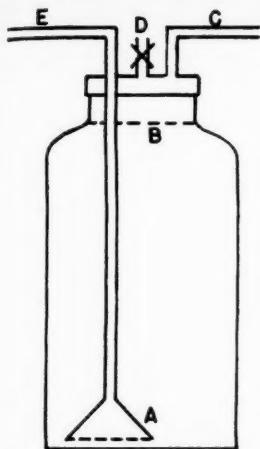


Fig. 1. Diagram of Apparatus Used for Laboratory-Scale Countercurrent Batch Desorption of Guayule Shrub

tom and an outlet and an air vent at the top, as shown in Figure 1.

In setting up the series each "C" was connected to the "E" of the next jar. In the first step of the extraction miscella was introduced at "C" of jar No. 1, and the heavier water and resin solution removed at "E" of the last jar in the series. In the leaching step, the leaching miscella was introduced at "E" of the last jar, and the lighter acetone solution was removed at "C" of jar No. 1. A 40-mesh screen was placed over the opening of funnel "A", and another at the mouth of the jar "B" to prevent clogging of the tubes with shrub.

The shrub used was dryland seven-year old Variety 593 grown at Salinas. After harvesting, it was parboiled 20 minutes and defoliated. The defoliated shrub was coarsely cut through an ensilage cutter, then by rotary knife cutter with a 0.5-inch screen, crushed by passing twice through crushing rolls with a 0.002-inch clearance between rolls, and finally hammer-milled through a 0.5-inch screen. This preparation was completed on the same day the shrub was harvested. Solvent extraction was begun the following day.

Each jar was loaded with 250 grams, dry weight basis, of the cut and crushed shrub. The moisture content of the shrub was adjusted to 60% by adding the proper amount of water where necessary for the sake of uniformity of different lots of shrub.

In the first run acetone was introduced at "C" in jar No. 1 with the air vents open on all jars. As each succeeding jar filled, its air vent was closed. When all jars were filled, jar No. 1 was drained through the system, forcing miscella from the last jar in the series. A gram and a half of acetone per gram of shrub was passed through jar No. 2; then it also was drained. This process proceeded until acetone had been added to the last jar, and it also had been drained. The miscella flowing from the last jar was cut into successive two-quart fractions, and each fraction used in order of emission in succeeding runs. The acetone remaining on the shrub was then recovered by leaching or back-washing. In this step the order of the cells was reversed—the last jar becoming the first of the series. Water was introduced at "E," overflowing through "C" into the next cell, etc., until all the jars were filled. The first jar was then drained through the system, and fresh water (four grams per gram of shrub) added to jar No. 2. The back-washing

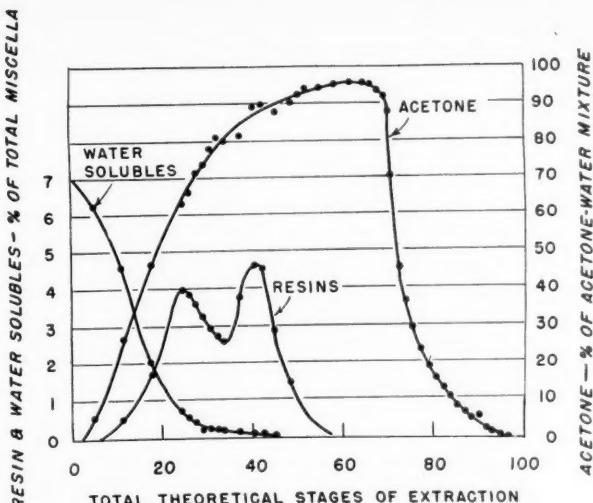


Fig. 2. Curves Showing the Progressive Composition of the Miscella in Countercurrent Batch Desorption of Guayule Shrub

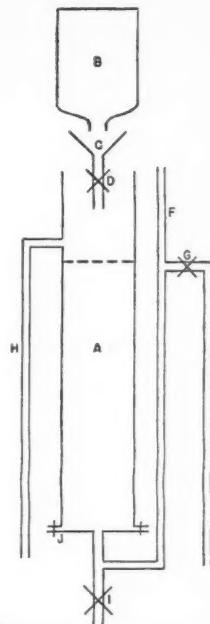


Fig. 3. Diagram of Extractor Used for Semi-Pilot-Plant-Scale Desorption of Guayule Shrub

continued in this manner with fresh water being added to each jar until all the jars were treated. This leaching miscella was also cut into fractions for use on the next run.

When the miscella had been used on six successive runs, it was considered that equilibrium conditions were well established, and each two-quart jar of miscella was sampled. Analyses were made for content of acetone, resin, and water solubles according to methods developed in this laboratory (12).

The determination of acetone in the miscella was based upon the specific gravity of a distillate from which the percentage of acetone was calculated. Water solubles were determined by evaporating an aliquot of the miscella to dryness on a steam bath, then extracting the dried sample with water for four hours in a siphon thimble extraction apparatus. The water extract was dried to constant weight in a convection oven at 65° C., and the percentage of water solubles calculated from this weight. Acetone solubles were determined by the difference between the percentage of total solids, determined by evaporation of another aliquot of the miscella, and the percentage of water solubles.

The curves in Figure 2 show the water soluble and resin concentrations attained in the extraction experiment, and the acetone content of the miscella at different stages. The different stages of extraction were arbitrarily divided into 100 theoretical stages for convenience and ease of presentation of the results.

Theoretical stages 1 to 66 inclusive cover the dehydration of the shrub and the extraction of resin with acetone; 67 to 100 cover the leaching of the shrub with water to recover the acetone.

The rapid and complete dehydration of the shrub (stages 1 to 66) and the sharp break in the curve (stages 67 to 100) from nearly pure acetone to a low acetone concentration are particularly noteworthy. Of extreme interest are the two high points in the resin concentration curve. This phenomenon has been evident in all the various miscellas produced and evidently denotes a partial fractionation of the extracted resins with respect to solubility in the advancing miscella. Between stages 15

and 20, miscella containing a high concentration of saponin-like materials was observed. The acetone curve illustrates the fact that there is no loss of acetone with either the outgoing miscella or shrub. In these runs the ratio of miscella to shrub on the dry weight was of the order of 12 to 1, and good extraction was obtained in about two hours. Limitations of the equipment prevented investigation of shorter extraction times, and different miscella to shrub ratios.

After each of the six runs was backwashed, two jars were selected at random for analysis of the shrub, and the shrub from 20 jars was pebble milled for recovery of the rubber. The resin analyses of both extracted shrub and rubber from each run are included in the mean values shown in Table 1. The chemical analysis of the rubber from the sixth run, for example, showed a resin content (as determined by ethanol extraction) of 1.66%, rubber hydrocarbon 89.70%, and ethanol and benzene insolubles 6.58%.

Semi-Pilot Plant Scale Extractions

In order to prepare sufficient quantities of shrub de-resinated rubber for physical testing and to make further observations on the extraction process, a battery of eight tubes 10-feet long by five inches in diameter was constructed of conductor pipe. These tubes were mounted vertically, and each was fitted with a device to provide a constant head for the introduction of acetone or miscella and a drain to provide semi-automatic operation. A design of these tubes is shown in Figure 3.

Tube "A" was filled with an amount of shrub equivalent to five kilograms dry weight, plus enough shrub for an analytical sample. This weight was chosen because it is the amount normally used as a pebble mill charge. Bottle "B" containing acetone or miscella was inverted over funnel "C," and the flow rate regulated by valve "D". Maintenance of liquid level and withdrawal of miscella were automatic through pipe "E" provided with anti-siphoning pipe "F." When extraction was complete, the acetone remaining in the tube was drained off through "I." Leaching with water to remove acetone from the shrub was accomplished by connecting funnel "C" to pipe "F," closing valve "G." Water and/or leaching miscella was introduced at "B" overflowing the acetone through "H." When leaching was complete, the water remaining in the tube was drained off; the bottom flange "J" removed, and the charge dumped into a container. As indicated in Figure 3, the extraction miscella flows downward through the shrub while the leaching miscella flows upward. These directions were chosen in order to minimize diffusion in the miscella by taking full advantage of the density differences of water, acetone, and mixtures of the two.

The shrub used in all of these runs was non-irrigated five-year old Variety 593. It was prepared on the day harvested in the same manner as described in connection with the previous small-scale extraction. The following day each extraction tube was loaded with one mill charge with as little packing as possible, and extraction started. Shrub moisture was not adjusted and varied from 45 to 49%.

Pure acetone was used in the first tube. As the miscella drained from the tube, it was cut into five-gallon fractions and used in succeeding extractions in the order of the cuts; the last cut of miscella was followed by pure acetone. Samples taken at regular intervals showed a rapid and complete dehydration of the shrub early in the process. The first cut, approximately five gallons, consisted essentially of water normally present in the shrub. It contained no acetone and was not used in succeeding

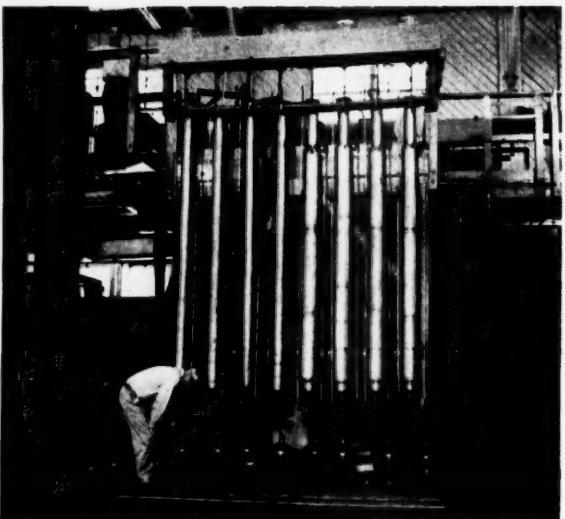


Fig. 4. A Battery of Eight Semi-Pilot-Plant-Scale Extraction Tubes Used for Guayule Shrub Deresination

extractions. As the amount of miscella increased, the amount of pure acetone added was diminished until approximately a pound and a half per pound of shrub was being used. After equilibrium conditions were approached, 2½ gallons of miscella were removed from the cut, where the resin concentration was 4-5%. This removal was done to maintain the resin balance in the system. The acetone concentration in the miscella removed was 60 to 75%, equivalent to 1-½ pounds of acetone per pound of shrub. The difference between this figure for acetone removed and the 1½ pounds added per pound of shrub is accounted for by evaporation in an open system. As will be shown later, this evaporation loss would not occur in a closed system. Concentrations of resin in the miscella and amounts of acetone to be removed and added are not necessarily the optimum that could be achieved in a continuous closed system.

When extraction was completed, the shrub was leached with water to remove the acetone by introducing water in the bottom and overflowing the miscella at the top of the tube, as shown in Figure 3. Cuts were also made in this miscella and used successively in order for leaching succeeding extraction tubes. Analysis of the first cut showed that it contained 98% or more acetone. This cut was used directly in the resin extraction step of a new charge of shrub. This acetone replaces that which is carried by the shrub from the extraction step to the leaching step.

A photograph of the extraction set-up used in these experiments is shown in Figure 4.

The rubber was recovered from the extracted shrub by pebble milling and dried to constant weight in a through circulation oven. The initial temperature used for drying was 100° F., which was gradually increased to 200° F. to complete dehydration. The average recovery of rubber hydrocarbon from 29 separate millings was 90.4% of that present in the shrub. This is comparable to the recoveries obtained from milling of shrub for resinous rubber.

Later additional extraction experiments were conducted in which the shrub was extracted with hot water prior to acetone extraction. This procedure was adopted because some trouble had been encountered with formation of precipitates in the backwash miscella, especially in those cuts where the miscella was rapidly changing



Fig. 5

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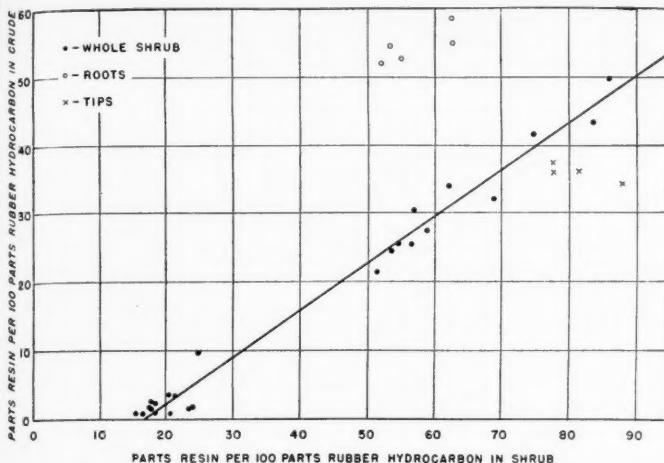


Fig. 5. The Ratio of Resin to Rubber Hydrocarbon in Guayule Shrub and Different Shrub Parts as Related to the Same Ratio in the Recovered Crude Rubber

from a high acetone content to a high water content. Removal of the water soluble material in this manner prevented the formation of precipitates in the miscella used later in the process in leaching the acetone from the shrub. Although the preliminary water extraction increased the shrub moisture from 50 to 75%, subsequent dehydration by the acetone miscella was readily accomplished, and the extraction of resin proceeded normally.

Resin-to-Rubber Ratios

Values for the content of resin in the unextracted shrub, the extracted shrub, and crude rubber produced from both extracted and unextracted shrub in all the runs are included in the means listed in Table 1.

It is worthy of note that approximately 65 to 70% of the total resin in the shrub is extracted by the deresination process. This results in a reduction of more than 90% of the resin normally present in the crude rubber.

Guayule generally contains from 5-10% of acetone soluble constituents or resin. During the pebble milling process commonly used for the recovery of resinous rubber, part of the resin becomes incorporated with the crude rubber as a major impurity. In most cases the crude rubber is found to contain about one-half of the total resin originally present in the shrub. Analyses of a large number of samples reveal that the ratio of resin to rubber hydrocarbon in the crude rubber obtained from freshly harvested, defoliated whole shrub is closely related to the ratio of resin to rubber in the shrub tissue. A similar relation is seen to exist with respect to partially deresinated shrub and the rubber milled from it. These relations are shown graphically in Figure 5.

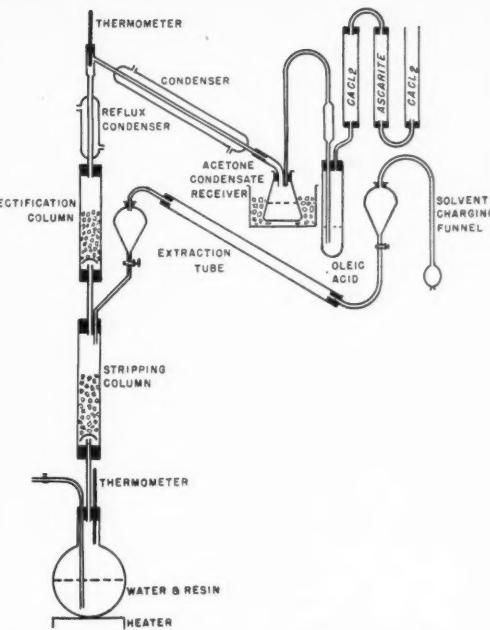


Fig. 6. Apparatus Used for Recovery of Solvent from Acetone Deresination of Guayule Shrub

When roots or branch tips of guayule shrub are pebble milled separately, however, somewhat different relations are found between resin-rubber ratios in the tissues of these parts and in the crude rubber. Essentially all of the root resin, for example, appears to combine with the rubber during milling since the resin-rubber ratios are not significantly altered by milling. Crude rubber recovered from the tips of guayule plants has a resin-rubber ratio lower than might be expected, judging from the relatively higher resin content of tip tissues.

These findings indicate that shrub tip resins are of a different nature, or at least in the pebble milling environment they behave differently than root resins do, because they do not combine so rapidly with the crude rubber during milling. Deresination of shrub by acetone extraction apparently removes the different types of resin of the whole defoliated shrub in the same proportions as initially present, as indicated by the constancy of resin-rubber ratios already referred to.

Quality of Shrub Deresinated Rubber

Detailed studies relative to the quality of shrub deresinated rubber, as indicated by physical tests of crude and compounded stock, are in progress and will be reported in a subsequent paper. Certain of the evaluation work is being conducted cooperatively with other laboratories.

TABLE 2. RESULTS OF PHYSICAL TESTS OF SHRUB DERESINATED GUAYULE RUBBER AS COMPARED WITH RESINOUS GUAYULE RUBBER AND *Hevea* SMOKED SHEET

Material	Mooney Viscosity ML 212° F. 5 minutes	Ultimate Tensile p.s.i.	Stress-Strain Data of Vulcanizates						Optimum Cure Time @ 287° F. Minutes
			Stress @ 500% Elongation p.s.i.	Stress @ 600% Elongation p.s.i.	Ultimate Elongation %	Elongation @ 400 p.s.i. %	Shore Hardness		
Commercial resinous guayule rubber*	45-55	2500-2700	350	....	800-850	....	25-28	....	....
Shrub deresinated guayule rubber	95	4060	830	1660	770	390	40	15	15
<i>Hevea</i> No. 1 smoked sheet.....	95.5	4620	865	1850	790	391	41	15	15

Formula: Rubber—100; stearic acid—4; zinc oxide—6; Captax—1.0; sulphur—2.5; DOTG—0.08.
*Average values reported by Place and Clark using special guayule formulae (13).

Results of preliminary tests are shown in Table 2, wherein data for shrub deresinated rubber are compared with corresponding data for *Hevea* No. 1 Smoked Sheet and commercial resinous guayule rubber. Stress-strain values for the respective vulcanizates indicate that the shrub deresinated rubber approaches *Hevea brasiliensis* in quality.

Solvent Recovery

An experiment was set up to estimate (a) the solvent losses to be expected in a closed system and (b) the effect of resin on the operation of a solvent recovery system. In making these tests, solvent was leached from the extracted shrub with water, and the total solvent recovered from the leaching as well as the extraction miscella was determined by weight and density of the distillation.

Apparatus and Procedure

Apparatus, as shown in Figure 6, was made of glass and consisted of a solvent charging funnel sealed with a valved rubber bulb; an inclined extraction tube one-inch in diameter 35 inches long, with lower end connected to the funnel and upper end connected into the top of a stripping column one-inch in diameter, packed with eight inches of $\frac{1}{8}$ -to $\frac{3}{8}$ -inch crushed granite and having a two-liter flask on lower end; a rectification column of the same diameter packed with 12 inches of $\frac{1}{8}$ -inch glass beads; a reflux condenser; a condenser; a tared condensate receiver packed in ice and vented through traps for volatile materials; and an 800-watt heater to boil the liquid in the two-liter flask.

Experimental operation was essentially batchwise. The shrub was prepared in the same manner as previously described for deresination. This material was placed into the tared extraction tube, and the gross weight of tube and shrub determined. A quantity of solvent of known specific gravity was weighed in the charging funnel, and the funnel connected to the extraction tube. When miscella reached the two-liter flask during an extraction, distillation was started with reflux kept high enough to get practically pure solvent as condensate. When all extracting solvent had flowed into the extraction tube, the shrub charge was washed with a weighed quantity of water added in at least two portions to minimize diffusion of solvent back into the charging funnel. The extraction and washing operations required somewhat less than two hours.

When leaching was completed, the extraction tube was drained into the stripping column, and boiling continued until vapor temperatures indicated that all solvent had left the rectifying column. The column was allowed to drain and cool for 16 hours between runs.

The wet shrub, the liquid in the flask at the bottom of the column, and the condensate were weighed. Specific gravity of the condensate was measured with a spindle of appropriate sensitivity.

Results of Solvent Recovery

According to these small-scale tests in which solvent quantities were determined by weight and density measurements, recovery was complete within limits of experimental error as shown by the results of Table 3. The recovered solvent, however, was checked for purity only by observation of the temperature of the vapor leaving the rectification column and the specific gravity of the condensate. Material balances indicated no appreciable

loss of volatile constituents from the shrub to the solvent.

In addition to these small-scale runs, 20 gallons of water, acetone, and resin mixtures from larger-scale extractions were separated in the same glass columns. There was no plugging by resin, and the separation of water and acetone was normal, indicating no interference by any of the dissolved materials.

TABLE 3. SOLVENT RECOVERY AFTER EXTRACTION OF RESIN FROM SHRUB

Run	Material	Recovery
1	Acetone	99.9
2	Acetone	100.0
3	Acetone	100.0
4	Acetone	99.7
5	Acetone	100.0
6	Acetone	100.3
7	Ethanol	99.8

Discussion and Conclusions

Results of acetone extractions of guayule shrub on laboratory and semi-pilot-plant-scale experiments have led to the following conclusions:

The low quality of crude resinous guayule rubber is largely ascribed to its resinous (acetone soluble) constituents. Crude rubber containing resin within a range of about 0.7 to 2.0%, in contrast to the normal content of 20 to 25% resin, can be produced by pebble milling shrub previously extracted with acetone at room temperature. The yield of rubber hydrocarbon is essentially the same as obtained in comparable millings of unextracted shrub.

Moist shrub may be extracted directly. This advantage is significant in that it eliminates the necessity of first drying the shrub with its attendant deleterious effect on the rubber. The quantity of acetone required is independent of the original shrub moisture. A higher shrub moisture results, however, in a higher ratio of miscella to shrub in the system. The preliminary removal of water solubles has little or no effect on rubber quality as revealed by the tests made thus far.

The resin content of the miscella has two maximum points—one at 60-65% acetone, and the other at 85-90% acetone. The reason for this phenomenon is unknown, but the possibility of withdrawing at least two different types of resin extract from the system in a continuous countercurrent process is indicated.

Acetone is removed from the extraction system in two ways: (a) That withdrawn with the miscella for the removal of resin. This can be recovered by distillation and returned to the system. (b) That remaining in the shrub as it leaves the extraction step. This acetone can be completely recovered by leaching or backwashing the shrub with water. The first cut of acetone so recovered is practically water free and can be returned directly to the extraction step.

In a laboratory-scale batch countercurrent process, good extraction was obtained in two hours. Limitations in operation of the apparatus used both in the laboratory and in the pilot plant precluded a determination of the minimum contact time.

The crude rubber obtained by milling deresinated shrub is distinctly superior to and more uniform than the ordinary resinous product and approaches the quality of *Hevea* No. 1 Smoked Sheet. Results of physical tests reported in this paper should not be regarded as the optimum that may ultimately be realized for guayule rubber. While deresination constitutes the best prospect for quality improvement, other factors influence quality, such as methods of handling the shrub from harvest to mill, inclusion of plant material in the rubber, etc. These

(Continued on page 569)

Gilmer Timing Belt Developed



Fig. 1. Fine Wire Reinforcement Being Layed up on a Winding Machine during Manufacture of Gilmer Timing Belt

THE Gilmer timing belt, a rubber and fabric belt that fulfills the need of a power drive which will not slip and which permits precision timing, has been developed by United States Rubber Co., Rockefeller Center, New York 20, N. Y. Large-scale production has been started of the belt which has the same general appearance as a conventional flat belt except that it has regularly spaced teeth along one side which engage in corresponding grooves in the pulley. The belt can be made in any desired width and in a variety of materials to suit specific applications.

Under development for 12 years by the company's L. H. Gilmer division, the new belt is now in production in the Gilmer plant at Philadelphia, Pa., and will be marketed initially through the division. Current production is limited to specifically engineered applications, but the company expects to offer a standardized line of stock drives in both heavy- and light-duty constructions, with a sufficient number of pulleys to give an adequate range of speed ratios.

Advantages and Disadvantages of Belt

The Gilmer timing belt is said to have the following advantages:

(1) Completely positive drive. The belt makes positive engagement with the pulleys and eliminates slip, creep, and speed variation.

(2) Precision timing. Speeds of the driving and driven pulleys are perfectly synchronized.

(3) No stretch. The steel cable pulling element in the belt eliminates elongation (see Figure 1).

(4) Low or high speeds. The belt is equally efficient for low speeds in inches per minute, or high speeds up to 16,000 feet per minute.

(5) Fixed centers with no adjustment. The wire cable construction permits the belt to operate on fixed centers without take-up adjustments.

(6) No initial tension. The belt does not depend on

initial tension and, therefore, gives high efficiency and extremely low bearing pressures.

(7) High tensile strength. The steel cables give the belt greater pulling power, and the belt size can be varied to provide for any horsepower requirement.

(8) Low operating noise level. Tests have shown that the timing belt drive is quieter than precision gears running in an oil bath.

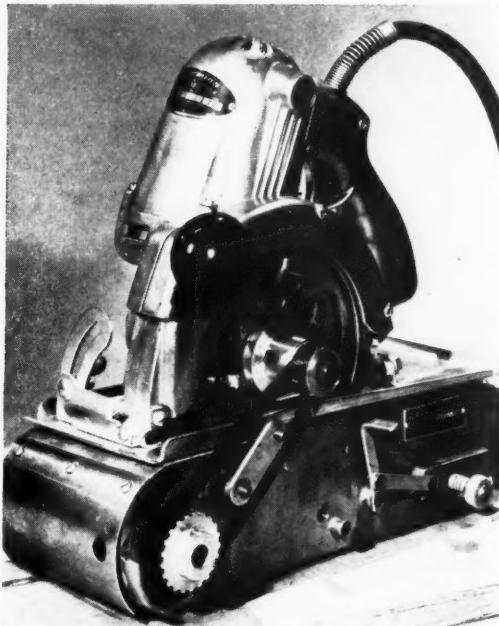


Fig. 2. Elimination of Lubrication Problem, No Slippage, and No Effect from Overload Shock Features Timing Belt in This Portable Sander and Saw

(9) No lubrication. The belt requires no lubrication or dressing and is suitable for use in hitherto troublesome application (see Figure 2). On the other hand, the belt is not harmed by oil.

(10) Compactness. Substantial space savings are usually realized with timing belt applications. Speed ratios are practical up to 30:1 under certain conditions.

(11) Economical. Maintenance cost is low because of absence of take-up from stretch, elimination of lubrication, infrequent replacements, and elimination of power waste. In addition, initial cost may be lower than for other types of drives because of the smaller drive dimensions.

(12) Versatile. The belt can be used as a power transmitter, timer, or other functional part.

There are several disadvantages at present of the timing belt. It is more sensitive to misalignment than V-belts or flat belts, but not so sensitive as gears or chains. Considerable engineering is required to apply the timing belt properly, but this problem is expected to be overcome with time and experience. While economical to use in comparison with chains and gears, the timing belt is somewhat more expensive than standard belts on light-duty drives. As the horsepower or size of the drive increases, the timing belt becomes relatively less expen-

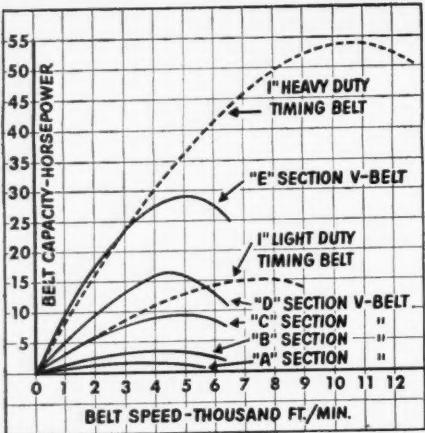


Fig. 3. Theoretical Horsepower Ratings of Light- and Heavy-Duty Stock Timing Belts Compared with Those of Five V-Belt Types

sive. On large drives the new belt is much less expensive than V-belts or flat belts. Finally, experience in application of the belt is still being gained, and many of the problems described here are expected to be solved in time.

Construction and Ratings

While there is one basic construction for most timing belts, many special constructions have been developed for specific applications. Basically, the belt is made with two strength materials: steel for most power transmission drives and Ustex treated cotton cord for light drives. Neoprene compounds are generally used, except where extreme heat and oil conditions require nitrile rubber.

No horsepower tables have as yet been published for timing belts, but they can be drawn up for stock drives. Figure 3 shows the horsepower curves of the five standard multiple V-belt constructions together with those of the proposed stock types of light- and heavy-duty timing belts. These curves show that the timing belt size for size will transmit considerably more horsepower than the V-belt and also gives peaks at much higher speeds than V-belts.

Development Status

Fundamental and basic development work on the timing belt has been completed, and the company is now producing special belts in standard constructions. A considerable amount of development work is still to be accomplished.

Some of the proposed development projects that appear desirable follow:

(1) Horsepower ratings. While such ratings can be published for stock drives, it will probably take a number of years thoroughly to check them. Such a program is now under way on a small scale and is expected to expand as production of the belt expands.

(2) Investigation of straight running feature. An investigation is under way to determine the factors that effect straight running in an attempt to reduce the belt's sensitivity to misalignment.

(3) Fiberglas strength component. Preliminary investigation indicates that Fiberglas is an excellent cord material for timing belts, and further work on this type of belt construction is in progress.

(4) Extreme resistance to effects of oil and heat. While present constructions are good, they can and

should be further improved to permit use of the belts in severe applications.

(5) Noise. Development work is expected to reduce or eliminate the little noise emitted by the belts at extremely high-speed ranges.

(6) Tooth form. Development work is incomplete insofar as tooth form is concerned. While present practice is satisfactory, the tooth forms can probably be improved.

(7) Timing belts with teeth on both sides. There is an appreciable market for such belts, and development work can be expected to result in a satisfactory double-sided timing belt.

(8) Non-endless timing belts. Inquiries have been received for non-endless timing belts, and their development is expected to be just a matter of time.

Stock Drives

At present the timing belt is in the same sales position in which V-belts were some 30 years ago, in that patterns are made and pulleys machined for each individual application. It is, therefore, advisable that timing belt stock drives be provided. To cover the field the belt would have to be furnished in two constructions: one for heavy duty and the other for light duty. In addition, there would have to be a sufficient number of pulleys to give an adequate range of speed ratios.

The following stock drives are being considered: (1) 92 heavy-duty belts ranging in length from 27-140 inches and in width from one inch to three inches; (2) 60 heavy-duty pulleys ranging in diameter from 3-25 inches; (3) 90 heavy-duty speed ratios ranging from 1:1 to 7.80:1; (4) 45 light-duty belts ranging in length from 21-54 inches and in width from one-half to one inch; (5) 48 light-duty pulleys ranging in diameter from 1.9-14.3 inches; and (6) 118 light-duty speed ratios ranging from 1:1 to 7.5:1. Insofar as stock drives are concerned, the company has decided to standardize on two pitch dimensions: 0.500-inch for heavy-duty belts and 0.375-inch for light-duty belts.

Shortage of Crude Rubber in Brazil?

Brazil's growing rubber manufacturing industry is consuming increasing quantities of crude rubber, and it seems feared that supplies of the home-grown product will prove inadequate for 1951 requirements. Consequently the Amazon Credit Bank, successor to the Rubber Credit Bank, has applied for permission to import 4,500 tons of crude rubber from abroad by April 1. At the same time efforts are being made to stimulate collection of local rubber, and a resolution was recently passed raising the ceiling price of crude rubber to 22.7 cruzeiros per kilogram, retroactive to October 1, 1950, an increase of about 25%.

So Sorry

In our November, 1950, issue the article, "N-Cyclohexyl-N', N'-Diethylthiocarbamyl Sulfenamide as an Accelerator," by Glen Alliger and S. R. Harrison, indicated that both authors were affiliated with Firestone Tire & Rubber Co. Mr. Harrison since May 15, 1950, has been with Fremont Rubber Co., Fremont, O.

Compounding of Butyl Rubber with Fine Particle Silica

Ralph F. Wolf¹ and F. W. Gage¹

AT NO time since Butyl rubber (GR-I) became commercially available early in the last decade has it been possible to make really satisfactory non-black compounds with this elastomer.

Tensile strength and tear resistance of stocks compounded with clays or whittings are unsatisfactory. Physical properties of compounds containing Silene EF are better, but the difficulty of dispersing this pigment in Butyl up to the present time has prevented its widespread adoption.

Hi-Sil, the fine particle silica pigment introduced to the rubber industry in 1949, appears to be the answer to the problem of producing satisfactory non-black Butyl rubber compounds. By use of this pigment, readily processable stocks can be made having properties better than those obtainable with the semi-reinforcing furnace blacks commonly employed.

Hi-Sil is a hydrated silicon dioxide having a particle size of 0.025-micron as measured by the electron microscope, approximately the same as that of EPC black. Specific gravity of Hi-Sil is 1.95. Refractive index of the pigment is 1.44. The surface area is 100-110 square meters per gram as determined by the Brunauer-Emmett-Teller nitrogen adsorption method.

Mixing Characteristics

Hi-Sil appears to be readily incorporated into Butyl rubber. It disperses well, using the standard mixing methods for Butyl, and there are few, if any, visible

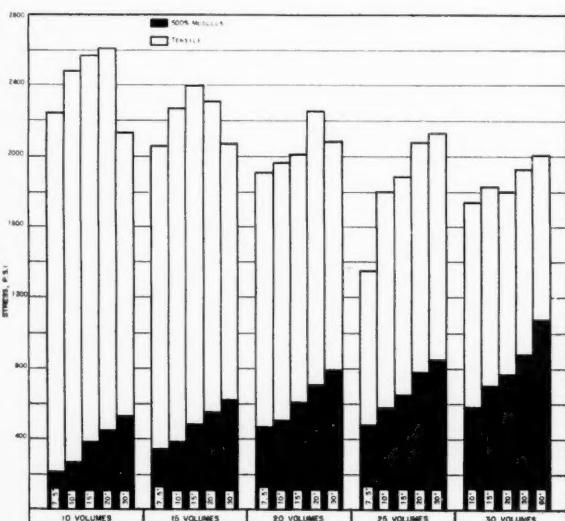


Fig. 1. Stress-Strain Properties of Hi-Sil in Butyl Rubber at 10-, 15-, 20-, 25-, and 30-Volume Loadings; Stocks Cured at 307° F.

specks or agglomerates in the resulting compound. Therefore in the mixing of Butyl stocks containing Hi-Sil it is suggested that each plant follow the same procedure now used in mixing black stocks.

Mill Roll Sticking

Hi-Sil loaded Butyl compounds will stick to mill rolls although to a lesser extent than do Silene EF stocks.

The sticking tendency can be entirely prevented by use of one part per hundred (PPH) or less of BxDC² (butoxyethyl diglycol carbonate) on the Butyl. Most of the results given in this paper were obtained with compounds containing one PPH of BxDC. Depending on the factory equipment involved, it is possible that the amount of BxDC required can be reduced to 0.75 PPH or even 0.5 PPH. This amount of BxDC will not interfere with subsequent steps in stock preparation, such as plying or splicing.

Volume Loading Results

TABLE I. COMPARISON OF VARIOUS VOLUME LOADINGS OF HI-SIL IN BUTYL RUBBER

Loading	Cure at 307° F. Min.	Mod- ulus 500% p.s.i.	Tensile p.s.i.	Elong- ation %	Formula	
					Duro. Hard. (O°)	Tear Lbs./In.
10 vols. (19.5 parts)	7.5	210	2240	920	45	130
	10	270	2480	890	47	120
	15	380	2570	840	47	90
	20	440	2610	800	48	90
	30	530	2130	740	48	60
15 vols. (29.25 parts)	7.5	340	2060	900	50	160
	10	380	2270	910	53	150
	15	480	2400	840	54	140
	20	550	2310	780	55	140
	30	620	2070	770	55	100
20 vols. (39 parts)	7.5	470	1910	860	55	190
	10	510	1970	830	57	180
	15	610	2010	780	60	180
	20	710	2260	780	61	160
	30	790	2080	710	58	140
25 vols. (48.75 parts)	7.5	480	1350	740	60	180
	10	580	1800	810	64	190
	15	650	1890	760	66	200
	20	780	2080	750	66	190
	30	850	2130	720	67	170
30 vols. (58.5 parts)	10	580	1740	820	63	200
	15	700	1830	780	65	200
	20	770	1800	750	66	200
	30	880	1930	730	66	200
	60	1080	2010	690	67	180

The results obtained with loadings ranging from 10 through 30 volumes of Hi-Sil over a range of cures are shown in Table I and Figure 1.

Although a great deal of the early work reported below on acceleration was done with compounds con-

¹ Pittsburgh Plate Glass Co., Columbia Chemical Division, Barberton, O.

² Product of Columbia Chemical Division.

taining a more or less conventional 30 volumes of Hi-Sil, later experimental work was done on 20-volume loadings. The higher amount quite possibly results in overloading of the elastomer because of the fine particle size and high surface area of the pigment.

It is suggested that for most uses no more than about 20 volumes of Hi-Sil be used in Butyl. It will be noted by examination of Table 1 and Figure 1 that above 20 volumes, rate of cure is much slower, and properties are not particularly improved.

Acceleration Experiments

Under the best conditions Butyl rubber is a difficult material to vulcanize because of its low unsaturation which is only about 1.40 that of natural rubber.

Use of a relatively high amount of an ultra-accelerator, such as tetra methyl thiuram disulfide, will give good cures in Butyl compounds loaded with comparatively non-adsorptive pigments such as SRF black.

Hi-Sil, however, is a reinforcing pigment of high surface area. When a very adsorptive material such as Hi-Sil is substituted for a less adsorptive pigment, the curing problem is aggravated.

One PPH of a thiuram or a dithiocarbamate is not sufficient to cure a 30-volume Hi-Sil loaded Butyl compound. This point is illustrated in Table 2 and Figure 2.

TABLE 2. COMPARISON OF RATE OF CURE OF SRF BLACK AND HI-SIL LOADED BUTYL STOCKS ACCELERATED WITH NORMAL AND INCREASED AMOUNTS OF ULTRA-ACCELERATORS

Pigment	Accelerator	Formula		Cure at 307° F.	Modulus	Elongation	Duro.	Tear
		GR-I	500° F.					
SRF Black 54 PHR (30 vols.)	TMTDS 1	As shown	100	Undercured				
		10	550	1900	880	53	200	
		15	820	2040	830	55	180	
		20	1050	2070	780	56	120	
		30	1110	1760	700	54	120	
		60	1230	1230	500	56	110	
Hi-Sil 58.5 PHR (30 vols.)	TMTDS 1	As shown	2	Undercured				
		10	230	700	1070	66	100	
		15	330	990	970	69	130	
		20	430	1250	880	70	160	
		30	580	1430	860	72	180	
		60	820	1620	750	76	230	
Hi-Sil 58.5 PHR (30 vols.)	Tellurac 1	As shown	2	Undercured				
		10	240	890	1070	59	130	
		15	370	1080	920	60	150	
		20	440	1230	900	61	160	
		30	550	1500	840	62	180	
		60	770	1720	800	64	230	
Hi-Sil 58.5 PHR (30 vols.)	TMTDS 2	As shown	2	Undercured				
		15	600	1670	830	66	190	
		20	740	1840	790	66	190	
		30	820	1930	760	68	190	
		60	1110	1900	750	70	170	
		15	700	1830	780	64	200	
Hi-Sil 58.5 PHR (30 vols.)	Tellurac 2	As shown	2	Undercured				
		20	850	1800	720	63	200	
		30	960	2040	720	64	200	
		60	1250	1830	610	67	160	

Results obtained with one PPH Pip-pip, Methyl Zimate, Butyl Zimate, Butyl 8, Bismate, or Ethyl Selenac were all poorer than those given by tetra methyl thiuram disulfide (TMTDS) or Tellurac and, consequently, are not shown, nor were they run at 2 PPH concentration.

The faster rate of cure obtained by use of 2 PPH of either of the latter two accelerators is illustrated in Table 2 and Figure 2. Good physical properties are attained at 307° F. after 20 minutes, which is a not unreasonable curing time for many articles.

The cost of using two PPH of TMTDS or Tellurac is

objectionable, however, and an attempt was made to achieve the same results with lesser amounts of these two materials.

Definite, but insufficient, improvement was obtained by addition of 0.5 PPH of Polyac, 2.6 PPH thiourea, 3.5 PPH diethylene glycol, or 4 PPH triethanolamine to 1 PPH of TMTDS. Addition of both Polyac and triethanolamine proved slightly better than either one alone, but in all tests in this group curing times of at least 60 minutes were required.

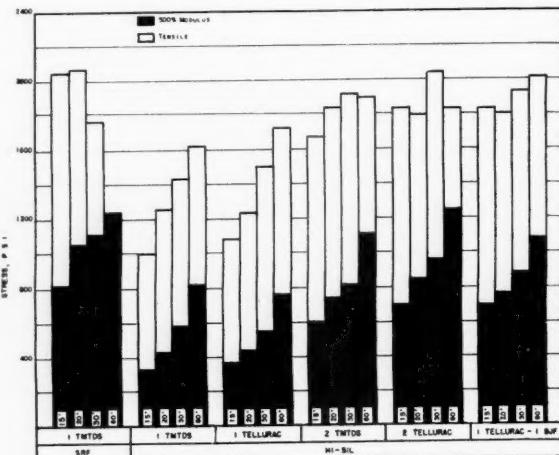


Fig. 2. Comparison of Stress-Strain Properties of SRF Black and Hi-Sil Compounds at 30-Volume Loadings in Butyl Rubber Using Various Accelerators; Stocks Cured at 307° F.

TABLE 3. COMPARISON OF RATE OF CURE OF HI-SIL LOADED BUTYL STOCKS ACCELERATED WITH TELLURAC ALONE AND IN COMBINATION WITH BPF

Acceleration	Formula		Cure at 307° F.	Modulus	Elongation %	Duro. Hard. (O*)	Tear Lbs./In.
	GR-I	500° F.					
Tellurac	2	15	700	1830	780	64	200
	20	850	1800	720	63	200	
Tellurac BPF	30	960	2040	720	64	200	
	60	1250	1830	610	67	160	
Tellurac	1	10	580	1740	820	63	200
	15	700	1830	780	65	200	
Tellurac BPF	20	770	1800	750	66	200	
	30	880	1930	730	66	200	
Tellurac	60	1080	2010	690	67	180	

Combinations of one PPH TMTDS with one PPH Bismate, Tellurac, Methyl Zimate, or Ethylac were then tested. TMTDS-Tellurac was equivalent to two PPH of either material used alone. The other combinations were slightly poorer.

Combinations of one PPH Tellurac with one PPH of Bismate, Methyl Zimate, Ethylac, or Tetronate were in every case definitely better than their TMTDS counterparts, but no better than two parts of Tellurac alone.

Because Tellurac appeared to be slightly more effective than TMTDS when used in equal amounts by weight, additional work was done with it.

As in the case of TMTDS, addition of Polyac and triethanolamine separately or in combination did not greatly improve a Tellurac stock.

Besides the combinations with thiurams and dithiocarbamates mentioned above, some tests were run with Tellurac in combination with typical aldehydes, amines, guanidines, and thiazoles.

Tests were run using one PPH Tellurac as the pri-

many accelerator in combination with one PPH of such secondary accelerators as 808, DPG, MBT, MBTS, BJF, and Acrin. All these were faster curing than one PPH of Tellurac alone. The combination with BJF was just as good as two PPH Tellurac and is, of course, cheaper. Comparative results are shown in Table 3 and Figure 2.

As a result of some later work on the possibility of curing without free zinc oxide, it was found that Zenite

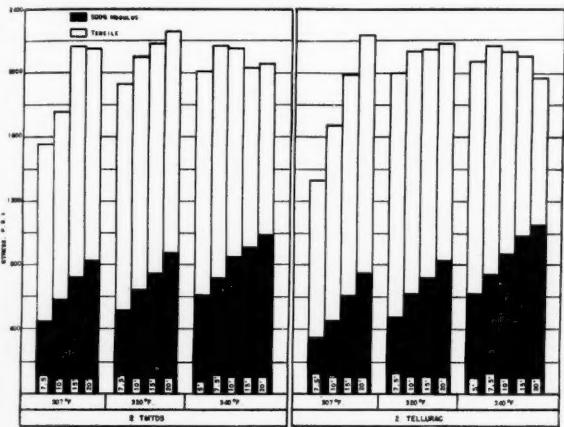


Fig. 3. Comparison of Stress-Strain Properties of 20-Volume Hi-Sil Loaded Butyl Rubber Stocks Accelerated with Tellurac and TMTDS and Cured at 307, 320, and 340°F.

TABLE 4. EFFECT OF INCREASED CURING TEMPERATURES ON 20-VOLUME Hi-SIL BUTYL STOCK ACCELERATED WITH TMTDS

	Formula	GR-I	Hi-Sil	Zinc oxide	Sulfur	TMTDS	BxDC
		100	39	5	2	2	1
Temp. of Cure, °F.	Time of Cure, Min.	Modulus 500% p.s.i.	Tensile p.s.i.	Elongation %	Duro-Hard. (O*)	Tear Lbs./In.	
307	7.5	440	1560	940	55	160	
	10	580	1760	870	58	160	
	15	720	2160	830	60	170	
	20	820	2140	780	60	180	
	30	920	2100	720	61	160	
Tear Lbs./In.							
200	5	430	1740	880	60	170	
200	7.5	510	1930	830	61	190	
200	10	640	2100	800	61	180	
160	15	740	2180	750	61	160	
200	20	870	2260	730	61	140	
200	340	5	610	2010	60	200	
200	7.5	720	2170	780	60	190	
200	10	850	2160	740	60	180	
180	15	910	2030	700	61	140	
	20	990	2060	680	61	160	

TABLE 5. EFFECT OF INCREASED CURING TEMPERATURES ON 20-VOLUME Hi-SIL BUTYL STOCK ACCELERATED WITH TELLURAC

	Formula	GR-I	Hi-Sil	Zinc oxide	Sulfur	Tellurac	BxDC
		100	39	5	2	2	1
Temp. of Cure, °F.	Time of Cure, Min.	Modulus 500% p.s.i.	Tensile p.s.i.	Elongation %	Duro-Hard. (O*)	Tear Lbs./In.	
307	7.5	340	1330	890	54	140	
	10	450	1670	870	55	180	
	15	610	1990	810	55	180	
	20	740	2230	810	56	190	
	30	790	2270	780	58	170	
Tear Lbs./In.							
320	5	410	1670	870	60	140	
320	7.5	470	2000	860	60	160	
320	10	620	2130	800	60	180	
320	15	720	2140	760	60	180	
320	20	820	2180	720	60	170	
340	5	620	2070	780	55	210	
340	7.5	740	2170	750	57	200	
340	10	870	2130	710	57	180	
340	15	980	2100	670	59	140	
340	20	1050	1970	630	59	120	

in combination with Tellurac was as good as BJF. This point is not shown in Table 3 because a lower volume loading was used. Direct comparisons of Tellurac-BJF and Tellurac-Zenite are shown in Tables 6 and 7.

The Tellurac-BJF combination was not improved by addition of Polyac, nor was it aided by substitution of MgO for ZnO or use of MgO in addition to ZnO.

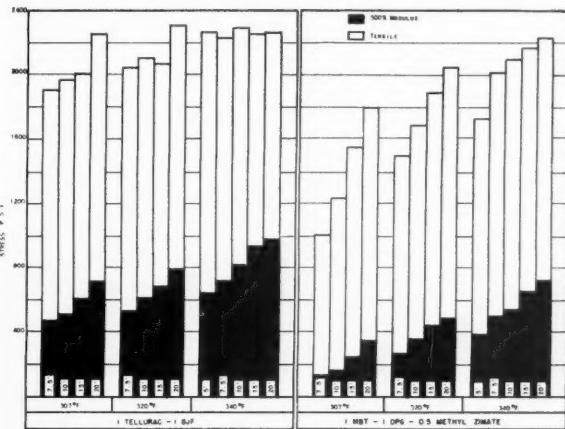


Fig. 4. Comparison of Stress-Strain Properties of 20 Volume Hi-Sil Loaded Butyl Rubber Stocks Cured at 307, 320, and 340°F, in Which Two Accelerator Combinations Were Used

TABLE 6. EFFECT OF INCREASED CURING TEMPERATURES ON 20-VOLUME Hi-SIL BUTYL STOCK ACCELERATED WITH TELLURAC-BJF

	Formula	GR-I	Hi-Sil	Zinc oxide	Sulfur	Tellurac	BJF	BxDC
		100	39	5	2	1	1	1
Temp. of Cure, °F.	Time of Cure, Min.	Modulus 500% p.s.i.	Tensile p.s.i.	Elongation %	Duro-Hard. (O*)	Tear Lbs./In.		
307	7.5	470	1910	860	55	190		
	10	510	1970	830	57	180		
	15	610	2010	780	60	180		
	20	710	2260	780	61	160		
	30	790	2080	710	58	140		
320	5	400	1690	880	56	170		
320	7.5	530	2040	840	60	190		
320	10	610	2100	810	57	200		
320	15	680	2070	750	59	160		
320	20	790	2310	770	60	160		
340	5	640	2270	830	57	210		
340	7.5	720	2230	770	60	190		
340	10	820	2300	750	60	210		
340	15	940	2260	720	61	190		
340	20	980	2270	690	61	140		

TABLE 7. EFFECT OF INCREASED CURING TEMPERATURES ON 20-VOLUME Hi-SIL BUTYL STOCK ACCELERATED WITH TELLURAC-ZENITE

	Formula	GR-I	Hi-Sil	Zinc oxide	Sulfur	Tellurac	Zenite	BxDC
		100	39	5	2	1	1	1
Temp. of Cure, °F.	Time of Cure, Min.	Modulus 500% p.s.i.	Tensile p.s.i.	Elongation %	Duro-Hard. (O*)	Tear Lbs./In.		
307	7.5	340	1630	960	53	170		
	10	310	1630	930	54	160		
	15	570	2140	840	58	190		
	20	650	2260	800	60	180		
	30	750	2300	750	60	160		
320	5	330	1730	950	55	160		
320	7.5	470	2030	890	56	190		
320	10	540	2140	860	56	200		
320	15	650	2070	790	56	180		
320	20	750	2300	780	59	200		
340	5	550	2180	880	60	220		
340	7.5	670	2160	800	59	210		
340	10	750	2280	770	61	200		
340	15	880	2300	740	61	160		
340	20	960	2280	710	62	160		

One PPH of triethanolamine did increase the rate of cure of the Tellurac-BJF stock somewhat, but this increase was achieved at some sacrifice of modulus.

Besides rate of cure, two other factors which must be taken into consideration in choosing acceleration are the cost of the accelerators and the color they impart to the cured article.

Tellurac imparts a yellowish color to the vulcanized product. This color would not be objectionable in anything except white or pastel goods or possibly in blues or maroons. As far as color is concerned, it is satisfactory in such things as red inner tubes or in olive drab molded or proofed goods. If Tellurac combinations are unsatisfactory because of color, it is suggested that TMTDS or MBT-DPG-Zimate be used.

Where cost of the acceleration is a primary consideration, the MBT-DPG-Zimate combination shown in Table 8 is of considerable interest. As it requires 30 minutes to cure at 307° F., it may not be of use where fast mold turnover is essential and higher curing temperatures cannot be attained. If it is possible to cure at temperatures as high as 340° F., this combination becomes definitely attractive.

The MBT-DPG-Zimate combination is considerably cheaper than Tellurac-BJF or Tellurac-Zenite. These, in turn, are substantially cheaper than 2 PPH TMTDS, and the latter is considerably cheaper than 2 PPH Tellurac.

Incidentally, MBT appears to be slightly, but definitely better than MBTS in this combination. Other thiazoles such as BJF or Zenite were not tested, but might be worth investigation.

Increased Curing Temperatures

Curing temperatures of 320° F., or even 340° F., are no longer uncommon in the vulcanization of Butyl rubber goods, particularly inner tubes.

For this reason several of the best curing combinations were chosen and run at the higher temperatures. Tables 4-8 and Figures 3 and 4 give comparisons of the 307, 320, and 340° F. curing curves of 20-volume Hi-Sil compounds accelerated with 2 PPH TMTDS, 2 PPH Tellurac, 1 PPH Tellurac plus 1 PPH BJF, 1 PPH Tellurac plus 1 PPH Zenite, and 1 PPH MBT plus 1 PPH DPG plus 0.5 PPH Methyl Zimate.

TABLE 8. EFFECT OF INCREASED CURING TEMPERATURES ON 20 VOLUME Hi-SIL BUTYL STOCKS ACCELERATED WITH MBT-DPG-METHYL ZIMATE

Temp. of Cure, °F.	Time of Cure, Min.	Formula				
		GR-I	Hi-Sil	Zinc oxide	Sulfur	MBT
307	7.5	100	39	5	2	1
	10	140	1230	1060	50	130
	15	140	1550	1000	50	160
	20	140	1800	910	54	190
	30	140	2000	860	56	190
320	5	180	920	940	55	120
	7.5	180	1500	950	56	150
	10	360	1690	930	56	180
	15	440	1890	850	60	180
	20	480	2040	840	60	190
340	5	380	1730	900	57	210
	7.5	500	2010	870	59	200
	10	540	2100	820	59	200
	15	650	2170	770	59	190
	20	720	2230	730	61	160

It will be noted that stocks accelerated with 2 PPH of either TMTDS or Tellurac cure in five minutes at

340° F., which is about one-third of the time required at 307° F.

The same is true of the Tellurac combinations with BJF or Zenite. As these are less expensive, they should be given strong consideration where high curing temperatures can be used.

The MBT-DPG-Zimate combination is slower than the others at 340° F., but is well cured in a reasonable time and should receive consideration both because of its lower cost and its lack of discoloration.

Comparison of Butyl Rubbers

The special Butyl rubbers, GR-I-18 and GR-I-25, are reputed to have faster curing rates than regular GR-I.

This statement appears definitely true in the case of 20-volume Hi-Sil loaded compounds cured with the Tellurac-BJF combination. Although the difference is not startling, reference to Table 9 shows that it does exist. One comparison was run at 307° F., and a five-minute cure was included purposely to magnify any differences. Regular GR-I is slightly slower than GR-I-18 or GR-I-25 throughout. This is also true in the series at 320° F.

TABLE 9. COMPARISON OF GR-I, GR-I-18 AND GR-I-25

Type of Butyl	Formula					
	Cure at 307° F. Min.	Modulus 500% p.s.i.	Tensile p.s.i.	Elong- ation %	Duro. Hard. (O*)	Tear Lbs./In.
GR-I	5	270	1290	930	55	160
	7.5	370	1620	910	56	170
	10	500	2000	860	56	210
	15	580	2070	820	56	210
GR-I-18	20	670	2100	780	58	210
	5	300	1530	880	51	210
	7.5	450	1970	850	55	210
	10	540	2300	840	56	210
GR-I-25	15	700	2370	800	58	210
	20	750	2450	780	57	180
	5	360	1650	960	53	180
	7.5	430	1790	870	56	210
GR-I	10	580	1960	820	56	210
	15	650	2110	790	59	210
	20	770	2300	770	60	180
	Cure at 320° F. Min.	450	1860	850	55	200
GR-I-18	7.5	510	2000	840	56	190
	10	710	2240	780	58	170
	15	740	2200	740	60	170
	20	720	2130	740	60	160
GR-I-25	5	550	2210	820	51	220
	7.5	620	2340	820	55	210
	10	820	2430	760	58	170
	15	870	2450	740	60	150
GR-I-25	20	870	2270	700	60	150
	5	610	2080	840	55	210
	7.5	680	2170	810	56	190
	10	910	2170	740	60	140
GR-I-25	15	950	2130	720	62	140
	20	940	2170	710	61	120

A test of GR-I R-20 in the same formulation showed it to be distinctly slower curing than regular GR-I. It had a very slightly higher modulus than the other Butyls, which is not unexpected, but its tensile strength was lower, and tear was about the same.

Suggested Inner Tube Compounds

Results obtained with Hi-Sil in three formulations which can be used as starting points for production of non-black Butyl inner tubes are shown in Table 10. The results shown in the first part of the table were obtained at a curing temperature of 320° F., and those in the latter part at 340° F.

TABLE 10. SUGGESTED HI-SIL BUTYL INNER TUBE FORMULATIONS

	Formulae					
	A	B	C			
GR-I.....	100	100	100			
Ht-Sil.....	40	30	30			
Soft clay.....	..	50	40			
Calceme T.....	..	..	40			
Zinc oxide.....	5	5	5			
Iron oxide.....	5	5	5			
Sulfur.....	2	2	2			
Tellurac.....	1	1	1			
BF.....	1	1	1			
BxDc.....	1	1	1			
Approx. vol. loading..	20	35	45			
Specific gravity.....	1.15	1.31	1.41			
Cure at 320° F. Min.	Modulus 500% p.s.i.	Tensile p.s.i.	Elonga- tion %	Duro. Hard. (O*)	Tear Lbs./In.	Perm. Set 500% E.
	Compound A					
5	480	1730	850	58	190	
7.5	600	2000	810	58	180	21
10	650	1930	780	60	210	21
15	750	1990	740	60	180	22
20	870	2070	730	62	150	
	Compound B					
5	450	1360	820	56	160	
7.5	550	1600	780	61	160	33
10	610	1650	770	60	160	33
15	680	1530	690	62	160	33
20	780	1520	660	60	150	
	Compound C					
5	580	1360	770	66	180	
7.5	700	1450	730	67	190	40
10	750	1500	710	68	200	39
15	820	1520	670	70	190	40
20	940	1500	650	72	180	
Cure at 340° F. Min.	Modulus 500% p.s.i.	Tensile p.s.i.	Elonga- tion %	Duro. Hard. (O*)	Tear Lbs./In.	Perm. Set 500% E.
	Compound A					
5	600	1870	800	59	230	
7.5	700	1930	750	58	190	23
10	790	2070	740	58	200	24
15	870	2110	720	61	170	25
20	940	1910	660	63	170	
	Compound B					
5	580	1670	760	60	220	
7.5	650	1620	710	61	220	35
10	700	1650	700	61	210	34
15	770	1730	690	62	210	35
20	810	1590	650	64	200	
	Compound C					
5	770	1500	710	69	220	
7.5	840	1550	670	69	220	40
10	910	1530	670	69	210	42
15	910	1600	660	70	210	42
20	980	1460	620	70	200	

Compound A contains slightly more than 20 volumes of Hi-Sil. Compound A has the lowest gravity and the best physical properties of the three compounds, but would also be the highest priced.

Compound B is cheaper and should also extrude better with less swell. It is somewhat slower curing and its tensile strength is less and its permanent set greater than for A.

If Compound A is satisfactory except for its tubing characteristics, it is suggested that enough soft clay be added to destroy the nerve and give a stock that will tube without much swell. This will be less than the amount of clay used in compound B.

If cost is of primary importance and some sacrifice in tensile strength and set can be tolerated, it is suggested that the more highly loaded compounds, B or C, be considered.

Owing to loss of internal cohesive strength with the increased loading in B and C it may be necessary in factory production to use more than the one PPH of BxDc shown. It is definitely known that three PPH will be ample to prevent sticking.

If a comparison is made with results given for other pigments in the Butyl booklet published by the Enjay Co. in 1948, it will be noted that the permanent set of Compound A is equal to that of the semi-reinforcing furnace blacks and channel black and definitely better than that of hard or soft clay, mica, diatomaceous earth,

or Silene EF. The permanent set of either of the more highly loaded compounds, B and C, is slightly poorer than an equivalent loading of SRF, but is better than channel black and much better than the clays, mica, diatomaceous earth, or Silene EF.

If Table 10 indicates the rate of cure at 320° F. is too slow and curing temperatures of 340° F. are not attainable, it is suggested that the substitution of GR-I-18 for regular GR-I be considered. Reference to Table 9 will show that it definitely cures somewhat the faster of the two rubbers.

Deresignation

(Continued from page 562)

are problems for continued investigation.

Shrub of different ages has been used, and the deresination work has been done over a period of time which covered essentially all seasonal variations in the shrub. To date, more than 200 extractions have been made. While the data obtained have not been sufficient at this stage of development to study in detail all the conditions which may affect the extractability of the resins and the quality of the rubber obtained, it can be stated with confidence that rubber of consistently low resin content and uniform quality can be obtained by shrub deresination.

Further work remains to be done on the effect of temperature, and relation between concentration of resin in the miscella and rate of extraction. Plans for the future include the development of continuous countercurrent extraction equipment which will facilitate a study of these and related problems.

Acknowledgment

The authors wish to express their appreciation for the results of physical tests of resinous and deresinated guayule rubber and *Hevea* smoked sheet conducted by Frederick E. Clark. The authors are also indebted to William J. Gowans and Mrs. Ruth V. Crook for chemical analyses of guayule shrub, miscella, and crude rubber.

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EDITORIALS

Promotion of Synthetic Rubber Products Now Needs "Reactivation"

The recent campaign of the rubber industry for the reactivation of the standby government synthetic rubber plants, made necessary by a new threat to our Far Eastern natural rubber supply, has been successful, and production of GR-S in the United States by April 1 should be at a rate of 60,000 long tons a month or more. The rubber goods manufacturing industry, however, now has another major responsibility in this connection.

This responsibility is that of "reactivating" its promotion and education of the public as to the value of synthetic rubber and synthetic rubber products, as compared with those of natural rubber or a major portion thereof. In spite of the efforts that have been made from time to time over the past several years to sell synthetic rubber to the American public, there are indications that many users of rubber products are still not completely sold on items identified as being made, either wholly or in part, of synthetic rubber.

With the drastic reduction, by government order, in the amounts of natural rubber that will be permitted in various rubber products during 1951, it would appear to be important that the industry make a new effort to explain again the comparative merits of synthetic *versus* natural rubber to its customers.

During the early postwar years the use of increasing amounts of natural rubber in American rubber products was made possible by better availability of that type of rubber, and the fabricating industry devoted its attention to emphasis on the quality of the product made by the individual company rather than on the amounts and types of rubber used in its manufacture, which was as it should have been at that time.

R. P. Dinsmore, vice president, Goodyear Tire & Rubber Co., in November, 1950, indicated in a general way the probable maximum synthetic rubber content that could be used in both transportation and non-transportation products without appreciable reduction in quality. Government specifications on natural and synthetic rubber content by products are expected in March and may parallel Dr. Dinsmore's recommendations or may even set a higher level of synthetic rubber content for some products.

Research and development on synthetic rubber of the general-purpose type during the postwar years have not produced a rubber that can be used as a direct replacement for natural rubber for all purposes. Cold rubber, i.e., GR-S polymerized at 41° F., has shown promise of being better than standard GR-S and equal to or better than natural rubber for some special uses such as tire treads, belting surfaces, etc., where its excellent resistance to abrasion may be used to best advantage.

A comprehensive report comparing GR-S, cold rubber, and natural rubber in tires, which includes the results of

15 months of road tests made by the Government Test Fleet, will be presented at the meeting of the Division of Rubber Chemistry of the American Chemical Society in Washington, D. C., on March 1. These results are part of an extensive study of rubber and carbon blacks conducted by the Office of Rubber Reserve in collaboration with carbon black producers. The tests were planned and supervised in a thorough and scientific manner and should provide the most conclusive proof to date of the advantage of the use of cold rubber in passenger-car and light truck tires. The information should be given the widest possible distribution by the American rubber industry in the interest of selling synthetic rubber to the public in a much more thorough way than it has ever been sold before.

It has also been reported that synthetic rubber has been made in small quantities that has hysteresis values equal to and even lower than those for natural rubber. As soon as these new rubbers are available in volume, we may find that we are very close to the realization of a synthetic rubber that may be used as a direct replacement for natural rubber.

In the recent past the producers of natural rubber spent much effort, time, and money extolling the virtues of that-type rubber and promoting its use in as many applications as possible. Except for privately produced specialty synthetic rubbers and cold rubber when it first became available in volume a year or so ago, support of synthetic rubber by the rubber goods manufacturing industry has not been too extensive.

The reasons for this situation were well known; all companies were required to use more or less the same general-purpose synthetic rubber, GR-S, which was produced under government supervision, and since rubber goods manufacturers were required to use a certain amount by law, there was no reason for the government to spend money promoting the use of synthetic rubber.

Although we are not involved in a major war, we are now in a state of national emergency in order to prepare for that possibility, and, as a result, rubber products are to be made mostly of synthetic rubber in order to conserve natural rubber. Although the general public may not generally realize the change that is taking place in the composition of their tires and other rubber products, many people do appreciate that a change is taking place and are unduly apprehensive about it. In the interest of present and future good will, a new campaign to promote synthetic rubber directed at the general public by the rubber industry would seem to be a very important and worthwhile project.

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Color Problems in Vinyl Film and Sheeting¹

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JUST a little more than 10 years ago colored plastics items were limited to rigid molded articles, largely phenolics, ureas, and cellulose acetate. Polystyrene and the rigid vinyls were then just taking hold. Since then a whole new industry based on the vinyl chloride polymers and copolymers has grown up. Much of the rapidity of this growth is due to dioctyl phthalate, generally known as DOP. In 1940, DOP was a laboratory product, but when it became a commercial product, the first really good vinyl films and sheetings became available.

With the introduction of plasticized vinyl films came a host of color problems because color is the item that sells plastics. The work done on the coloring of the rigid plastics, such as vinyl records, was of little value in attempting to color flexible vinyl films, and it has taken the colorant suppliers many years to realize this fact. As late as two years ago some colorant manufacturers were recommending oil soluble colorants for flexible vinyl films. No oil soluble colorant can be used with these films because of bleeding effects, which will be discussed later. There is no bleeding problem with unplasticized materials, and they can be colored with oil soluble colorants.

One of the purposes of this paper is to point out the very careful consideration which must be given before even as little as 0.01% of a colorant can be added to a vinyl film. Vinyl raw materials have chemical names and are treated as chemicals when they are added to a formulation. No compounder of vinyl film or sheeting would consider picking a raw material and adding 1% of it to a carefully developed formulation without knowing exactly what he was adding. On the other hand, some people think of colorants as inert ingredients which can be mixed in to produce a desired end-color effect. In general, less care is taken by the uninformed in adding colorants than in adding other raw materials. We must learn to think of coloring materials first as chemicals and second as colorants.

A few of the colorant suppliers have been willing to divulge chemical composition data, and to these companies real credit is due. Unfortunately much of the colorant industry is still operating under the old German dye industry practice of identifying nothing except by an elusive trade name. Suppliers withhold the composition from the user who needs it; yet their own competitors can readily analyze it.

The burden of the study of colorants has fallen on the resin manufacturers and the consumers. Until recently the research on

vinyl colorants could not be justified by the colorant suppliers because the volume sold was small. Fortunately this picture is rapidly changing.

While the claim is often made that vinyl films are available in an unlimited color range, a more correct statement would be that vinyl films are available in a wide range of stable colors. The range available varies with the end-use of the product, and lightfastness requirements are often the controlling factor. Let us examine a few of these end-products and see what particular problems are posed by each; then we shall outline the test methods used to select colorants with these end-uses in mind.

Requirements of Indoor Colorants

Closet accessories made of vinyl film or sheeting require freedom from odor development. In particular, the bindings of contrasting colors must be non-bleeding for when these items are folded up and packaged, the dark-colored trim is generally pressed into close contact with the lighter colored portions. The use of the wrong colorant here can be very costly.

Drapery are becoming extremely popular, and the trend is toward white films with printed designs. Vinyl resin-based inks are used for the printing, and the colorant problems are very similar to those where the colorant is incorporated into the plastic. The coloring of an opaque ink is much easier than the coloring of a transparent shade. As the colorant concentration goes down, the light stability problem becomes more difficult; bright pinks and rose shades cannot be made nearly so stable as standard reds.

The shower curtain problem is just about the same as that of window curtains because the same material is used in the bathroom window. The material must be heat sealable, and heat sealability can be affected by the colorants used if they sweat out.

When we get to the upholstery problem, we have come to the first sheeting item so far mentioned that is a permanent part of an expensive item. Above all, upholstery must be non-croaking. For indoor use the light stability is not too critical, but who knows when an upholstery material may be used outdoors?

Finally, we come to a really tough indoor application, the window shade. Here the ultimate in light stability is required as far as indoor applications are concerned

since shades become permanent parts of houses. We should be thankful that pink window shades are not required. Perhaps we should say we are thankful that shade manufacturers test colors carefully before making window shades!

Requirements of Outdoor Colorants

Proceeding now to the outdoor uses of vinyl films and sheetings, we find the metallic effect used in many raincoats is in itself a problem. The high reflectivity of aluminum makes it difficult to produce stable shades in all colors, I am sure no one would wear a vinyl raincoat when the sun is out; so the lightfastness requirement is not too high.

With luggage we have another so-called outdoor use where exposure to sunlight is only intermittent. Luggage can be classed along with indoor upholstery.

A more difficult lightfastness requirement is in the automobile upholstery field, particularly for convertibles. Unfortunately people who like convertibles and can afford them often can also afford to spend a lot of time in Florida where there is a lot of sunshine to do its work.

Finally, we come to outdoor applications where water as well as light takes part in degrading the film. The outdoor wading pools that have become so popular have high fastness requirements. A number of colorants have poorer stability under moist conditions than dry. Another tough application is the inflated articles often used in the ocean or at resorts where sunshine and moisture can do their work. These items are often quite expensive and certainly should last a number of seasons without color failure.

Problems in Vinyl Coloring

Several typical end-uses have been covered, and we have pointed out in a general way the problems encountered. Now let us examine the methods used in attacking the problem of making a good colored vinyl film or sheeting from three viewpoints:

- (1) Problems encountered in the manufacturing process.
- (2) Aging problems after the film has been made.
- (3) Cost factors in choosing colorants.

Manufacturing Problems

The primary requirements for a colorant in the manufacturing process are heat stability and retention of color. In addition, the colorant must be properly dispersed so

¹ Presented before Plastics Film, Sheeting, and Coated Fabrics Division, Society of the Plastics Industry, Inc., New York, N. Y., Dec. 14, 1950.

² Bakelite Division, Union Carbide & Carbon Corp., Bound Brook, N. J.

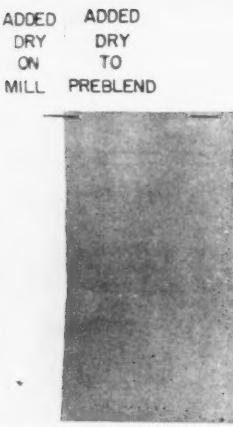


Fig. 1. Effect of Method of Addition on Dispersion of Colorant

that a uniform product results. Finally, color controls must be set up to insure lot-to-lot uniformity.

HEAT STABILITY. Most unsupported vinyl film and sheeting are produced by the calendering process in which compounds are hot mixed and passed through a set of heated steel rolls where the clearance between the steel rolls determines the final thickness of the finished product. Another process involves the casting technique where the resin and other ingredients are put into solution and cast on to a flat polished surface which passes through an oven to drive off the solvent. In each case the colorant is given heat treatment.

The heat stability of a colorant can be evaluated by two methods. The colorant can be incorporated into a batch, sheeted off on a two-roll mill, and statically heated; or the batch can be run on the two-roll mill for an extended period of time to give a dynamic test.

If you are press polishing sheeting to make plastic patent, or producing film by the casting process, then the method of static heating between plates is a necessary and desirable test. On the other hand, if you are producing a calendered product where the film is given no further heat treatment, the dynamic heat stability test is necessary.

Heat stability failures are of two types, and they are not always easy to separate. In one type the colorant may fail in itself; while in the other type the colorant will degrade the compound and yet be very heat stable in itself. In this latter case a formulation change will permit the colorant to be used. For example, iron oxides are often detrimental, but when sufficient amounts of alkaline stabilizers are added, will produce excellent colored compounds. Some pigment scarlets and some shades of ultramarine contain zinc oxide and have caused spotting trouble during static heating.

COLOR DISPERSION. The second manufacturing problem is that of dispersion. There are still a few people who add dry colorants to an already fluxed batch on a two-roll mill. With a highly plasticized compound this way is one to secure a very poor dispersion (see Figure 1).³ Much better dispersion can be accomplished by pre-blending the colorants with the other ingredients. By stripping the batch off the mill, cooling it, and refluxing it, far more work of dispersion can be done in a few

minutes than by continuous milling for a much longer time. This method can also be used to check the ease of dispersion of a colorant. If the colorant is very readily dispersible, there will be no change in intensity between adding on a mill and pre-blending.

To secure a product free from streaks it is best practice to predisperse the colorant in some manner. Grinding on a three-roll paint mill in a viscous plasticizer is a technique sometimes used. Some flushed colorants and some concentrated masterbatches also offer advantages over dry colorants.

What will poor dispersion of colorant do to the quality of the finished film? Generally it results in poor uniformity from beginning to end of a roll and poor batch-to-batch control. More colorant is required because it is not being effectively used. This practice is wasteful of colorants, a very important item in times of scarcity. Poor dispersion also results in specks which may end up as pin holes in the film. For inflatable toys film with a lot of pin holes is worthless.

There are wide differences in dispersibility of colorants of the same type obtained from different suppliers. Color differences such as these can be conveniently and quantitatively rated for strength by using the spectrophotometer. Figure 2 shows the spectrophotometric curves for four concentrations of a colorant. The stronger the colorant, or the better the dispersion, the lower the curve will be. These curves can be used as a check on the identity of a colorant and as an aid to color matching.

Color Control

Let us assume that a colorant has been secured which is heat stable and which does not affect the stability of the base compound. The colorant has been dispersed properly and added in the correct amount. Production begins; yet after a few days the film goes off color. We have failed to institute the necessary controls, which problem is the third in manufacturing.

Since colorants are generally made in small batches, they vary from lot to lot. We have already noted how the same colorant from different manufacturers varies widely. For good control, therefore, a check of every lot of colorant received against a reference standard sample is highly desirable. The cost of such a test is small in comparison with the loss in off-color product which might be produced in case of error.

Three control tests would be a minimum: (1) the color in massstone and tint is a simple test which can be done in comparison with a reference standard; (2) the tinting strength should be checked; and (3) the character of the residue on a 325-mesh screen is important because it shows how good a grinding job is being done by the manufacturer, and how much contamination is present. This third test is at best a tricky test to run.

Aging Problems

Now with good color control achieved and a colored film produced, the aging problems of this film in use arise. Up to this point the tests are quite straight-forward and decisions clear cut, but aging problems are really rough to solve because a lot of time is required in evaluation and in deciding on ways of speeding up effects which may take years to develop in service.

Aging problems are of several types and include migration, stability to light and

outdoor weathering, freedom from development of odor, and freedom from development of a sticky or oily surface. All these properties are directly affected by the choice of the colorants used.

BLEEDING. Colorants can migrate either by bleeding or by crocking, and a good vinyl film should not show any form of migration. Since there is sometimes a little confusion about the terms "bleeding" and "crocking," let us examine each more carefully.

In order to have bleeding two materials are necessary: the colored vinyl film and something else. If the film is to be used in contact with something into which the colorant might bleed, tests with the actual material should be made. If used for a soap container, then bleeding tests against soap must be run. No single bleeding test is applicable to all conditions.

To evaluate bleeding into a white vinyl film, the colorant is generally compounded in the vinyl formulation, and press-polished samples are prepared. The colored stock is then placed in contact with a white stock and clamped lightly. A 30-day test at room temperature or a one- to five-day test at 60° C. will generally suffice to show up bleeding of colorants (see Figure 3).

CROCKING. Crocking is distinguished from bleeding in that only the colored vinyl material itself is involved. A material is said to crock when there are colorant particles on its surface which may be easily rubbed off.

The AATCC Crockmeter is a convenient method of running the test by a standard method, although rubbing the material surface with a clean white handkerchief over your thumb will do nearly as well. Crocking tests on a material are generally run with both dry and water-wet pieces of cloth.

Crocking tests can sometimes be misleading. In general, the higher the colorant concentration, the greater the possibility of crocking. Be careful, however, because sometimes the reverse is true. Colorants which show more crocking at low than high concentrations belong to the pure organic types such as benzidine yellows, or thioindigo reds. Crocking effects will also definitely vary with the plasticizers and lubricants used.

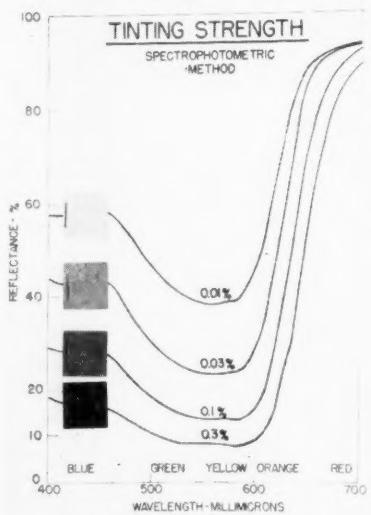


Fig. 2. Spectrophotometric Curves for Four Concentrations of a Colorant

³The author acknowledges the cooperation of J. R. Russo for the photographs used as illustrations.

Cost Factors in Choosing Colorants

Let us now consider the third problem in coloring vinyl film and sheeting, that of cost factors. There are five points to be made here:

(1) The cost in dollars per pound of a colorant is no indication of the actual cost to do given job insofar as coloring power or tinting strength is concerned. This point is illustrated in Figure 4, using a group of five blue colorants.

(2) No relation exists between the cost of a pigment and its light stability. For example, a vat colorant considered excellent for textiles and selling for about \$12 a pound is far inferior in light stability to the familiar molybdate orange selling at about 40¢ a pound.

(3) For a given specific pigment type the cost in dollars per pound from different suppliers is no indication of true cost in a job because coloring powers may vary.

(4) The purest form of a colorant which will be the most expensive in dollars per pound is the cheapest to use provided it can be dispersed properly. For example, a phthalocyanine blue at \$3.85 a pound is much cheaper to use than the diluted lakes at 40¢ a pound, which actually cost \$6.50 a pound in terms of pure color. In cases where the pure form cannot be dispersed readily, the diluted lake may actually prove cheaper to use because lakes are often easier to disperse.

(5) To match some shades only one pigment will do the job regardless of the cost.

If you are a film consumer looking for the lowest cost in materials, it may be better to compromise a little on the exact shade in order to save money. However, if you are willing to pay a higher cost, then some additional colors may be possible.

Summary and Conclusions

In conclusion may I summarize by saying that the coloring of vinyl film and sheeting is a complex job which requires time consuming and careful work from many angles. Today many of these colorant problems have been solved, and the quality film and sheeting now available is a reflection of these solutions. We hope that shortages of raw materials which may come in future months will not bring about hurried decisions to use colorants of unknown behavior merely to satisfy a market for a particular shade.

Fig. 3. Results of Test to Determine Colorant Bleeding into a White Vinyl Film

LIGHT STABILITY AND WEATHERING. The light stability problem is one of the longest to evaluate and one of the most difficult to solve. One factor that makes it difficult is the unreliability of tests made in other media. Excellent performance of a colorant in printing inks or paints is no assurance of good light stability in vinyl materials.

Because of the time factor and because there are only about four to six hours of sunshine per day on the average, there have been many attempts to secure an artificial sunlight source. To attempt the accelerated fading and weathering of vinyl materials, four units have been studied in the United States. First, there is the S-1 sunlamp, an ultra-violet source which has found little use because the results it gives are much too slow. Second, there is the FadeOmeter. This unit has been in use in the textile trade for many years for studying the fading of textiles. It is very unreliable for predicting the outdoor life of vinyl films because it shows very poor correlation with outdoor tests. The lack of moisture, poor temperature control, and a type of carbon arc which has a light output differing greatly from sunlight may be the reasons for the poor correlation of the FadeOmeter.

Third, there is the Twin Arc WeatherOmeter. This unit consists of two FadeOmeter light sources plus a water spray and may give more reliable correlation with outdoor tests. Finally, there is the Atlas XIA WeatherOmeter which provides the most reliable of the accelerated weathering tests now in use for predicting the outdoor behavior of plasticized vinyl compounds, provided it is operated with a reasonable degree of temperature control.

Sometimes people forget why they have accelerated units and run everything in them. The accelerated weathering unit should only be used to supplement outdoor tests, which are the primary tests. Any result obtained in an accelerated unit should be considered as just a preliminary answer and used only when there is a rush factor in the study.

No accelerated test known to date will show 100% correlation with outdoor tests. So far no one has defined the standard "outdoors." South Florida is a good place to run outdoor tests since it has a moderate climate, lots of sunshine, and plenty of moisture, a very important factor.

How good can the light stability of vinyl film and sheeting be? A great many colors can be made to stand up for 160 hours of summer sunshine in a four-mil film. A large number will stand up to 320 hours and higher, with black always the best. In opaque sheeting we do not know where the practical upper limit is in light stability, provided the market can stand the cost. Some colored sheetings which have been exposed in South Florida for 1,500 hours

exhibit reasonable stability. How many textiles will stand up for 1,500 hours?

If you are interested in the very brilliant shades for novelty applications, then the lightfastness may be quite low. With no information at hand, it is a reasonable general rule that the brighter the color, the poorer the light stability. Where should the line be drawn? I would say that any film which fades badly in 120 hours of direct outdoor summer sun should never be used for window curtains or drapes, and that is a very low minimum figure.

The manufacturer, fabricator, and retailer of colored films all have a definite responsibility in seeing to it that the proper colors are used for a given application. Occasionally a bright-shade film color is made for some novelty application where the buyer has some left over and decides to use it for a totally different application that requires much higher lightfastness. The consumer gets stuck and blames the whole industry, despite the fact that film producers cannot control the end-uses. The SPI Group III lightfastness committee is working on this problem and should do much to help with the rating of films for light stability.

SWEAT-OUT AND ODOR DEVELOPMENT. The coloring of vinyl film is further complicated by another property, that of sweat-out and odor development. This effect is due entirely to the colorant present. Colorants containing salts of metals which are normally considered as oxidation catalysts behave in this manner. By changing the formulation these effects can be minimized.

The "Cellosolve" phthalates and plasticizers derived from castor oil are particularly susceptible to this effect with certain oxidizing colorants.

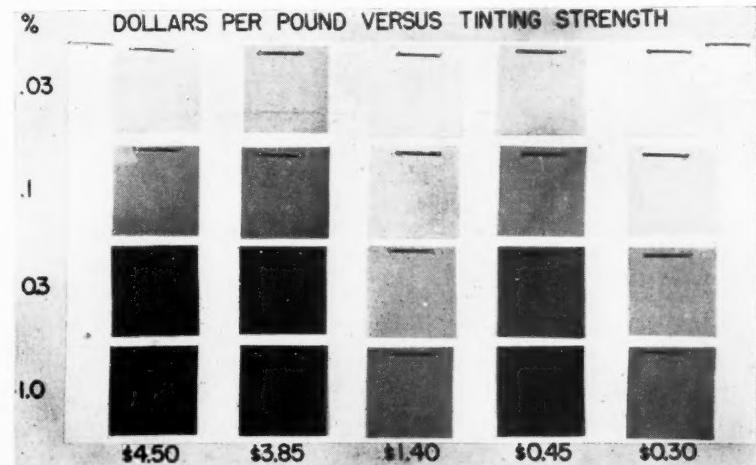


Fig. 4. Initial Costs of Five Blue Colorants Do Not Indicate Actual Tinting Strengths

SPE Conference Sets Records; Sections Also Meet

NEW records for registration were set by the seventh annual national technical conference of the Society of Plastics Engineers, Inc., held January 18-20 at the Hotel Statler, New York, N. Y. The total registration of approximately 850 persons was almost double the previous high of other SPE conferences and was also said to be a new high for any plastics convention. Average attendance at the morning and afternoon technical sessions was about 500; while 381 persons attended the luncheon session on January 18, and approximately 450 members, guests, and their wives were present at the annual banquet on January 19.

New national officers for 1951 were elected by the Society's national directors and announced at the luncheon meeting, as follows: president, Islyn Thomas, Thomas Mfg. Corp., Newark, N. J.; vice president, Walter O. Bracken, Hercules Powder Co., Wilmington, Del.; secretary, Walter F. Oelman, Standard Molding Corp., Dayton, O.; and treasurer, William J. Dunnican, Syivar Corp., Wilmington, Del.

Retiring President, J. Todd Clark, F. Burkhardt Mfg. Co., presided over the luncheon and the Society's annual business meeting which followed. In the business session Mr. Thomas spoke briefly on plans further to develop the Society during the coming year; while Mr. Clark reviewed accomplishments during 1950. Reports were also heard from Mrs. Bess R. Day, executive secretary; J. M. Church, of Columbia University and chairman of the education committee; Mr. Bracken, the 1950 national treasurer; Mr. Oelman, 1950 chairman of the finance committee; and Jesse H. Day, of Ohio University and chairman of the publications committee.

The annual banquet featured an after-dinner talk on "Synergism" by John P. Coe, vice president of United States Rubber Co. Defining synergism as the working together of two factors to produce a total greater than the sum of both parts, Mr. Coe applied this term to the results achieved by the cooperative work of the rubber and the plastics industries. After briefly describing the growth of the plastics industry, the speaker emphasized the impetus to plastics given by the development of synthetic rubber, both by stimulating fundamental research in high polymers and by providing a large capacity of styrene for peacetime applications. In addition, work on rubber and plastics has resulted in the development of gum plastics, the resin-rubber blends. Speaking of the diversion of styrene monomer from plastics to use in synthetic rubber in the government program, Mr. Coe estimated that about 60% of the styrene capacity will go into rubber in 1951.

The conference program ended with the presentation on January 20 of the three prize-winning papers in the 1950 SPE Prize Paper Contest. The winning papers in the order of their selection were: "Applications of Polyethylene in the Chemical Industry," George W. Blum, Case Institute of Technology; "Classification of Thermoplastic Resins from Their Plasticity Curves," W. H. Willert, Hartig Engine & Machine Co.; and "The Elevated Temperature Creep and Fatigue Properties of a Glass-Fabric Laminate," W. N. Findley and W. J. Worley, University of Illinois.

Other features of the conference were the distribution of 20 table favors to all attending the luncheon; the drawing for some 21 door prizes at the luncheon; the separate ladies' program, including tours,



Newly Elected SPE National Officers for 1951: (Left to Right) Secretary Walter F. Oelman, Vice President Walter O. Bracken, President Islyn Thomas, and Treasurer William J. Dunnican

fashion shows, etc.; and the distribution of orchids to all ladies attending the banquet, which included a program of Broadway entertainment followed by an evening of dancing.

Miami Valley Section Elects

New officers for 1951 for the Miami Valley Section were elected at a meeting of the board of directors on December 15, as follows: president, Martin H. Kasch, Kurz-Kasch, Inc.; vice president, Byron W. Nelson, National Cash Register Co.; secretary, Carl Weber, Crosley Division, Avco Corp.; and treasurer, Charles Selz, Kurz-Kasch. Walter G. Oelman, Standard Molding Corp., is again serving as national councilor for the group.

Directors elected to three-year terms were: Mr. Weber; Ralph Backscheider, Recto Molded Products Co.; and Otto Fiedler, F & F Mold & Die Works. Other directors of the Section are Messrs. Kasch, Nelson, and Selz; Merle Nelson and R. W. Gerdes, both of Plastic Moldings Corp.; and J. W. Brierley, Bakelite Division, Union Carbide & Carbon Corp.

The Section's annual Christmas party, held December 9 at the Miami Valley Golf Club, Dayton, was a great success. Some 80 members and their wives attended the party which featured bingo games, with prizes awarded to the winner. Favors were distributed by F & F Mold and Formica Insulation Co., and the party concluded with a buffet supper. Much of the credit for the success of the affair should go to the arrangements committee which consisted of J. A. Braden, Celanese Plastics Corp., and Messrs. Oelman, Brierley, Kasch, Selz, and Gerdes.

On January 4 the Crosley Division, Cincinnati, was host to the Section at a dinner and plant visit. At this meeting Retiring President Gerdes paid tribute to his fellow officers for their work during 1950, and turned the gavel over to his successor, Mr. Kasch.

Tenite in the Oil Country

A talk on "The Use of Tenite to Combat Corrosion in the Oil Country," by Lewis B. Connally, Tennessee Eastman Corp., featured the January 10 joint dinner-meeting of the Chicago Section, SPE, and the Midwest Chapter, SPI. Held at the Builder's Club, Chicago, Ill., the meeting was attended by 110 members and guests of the two groups.

Using slides to illustrate his talk, Mr. Connally discussed the causative factors for the corrosion problems encountered in the oil producing country, including salt

water, sour crude oil, sour earth, and electrolytic action. Extruded Tenite tubes have been used thus far for low-pressure lines, such as ground lead lines, and to some extent for disposal well tubing, with excellent results. The plastic tubing has proved superior to other methods of combating corrosion. Teflon-lined steel is difficult to manufacture and has a very high cost; steel pipe spray coated with vinyl does not show equal joint life; Transite cement-asbestos composition is bulky, has low impact resistance, and comes in short lengths; and cement-lined pipe is costly, heavy, fragile, and difficult to apply. Tenite extruded as a uniform tube cut to 20-foot lengths and assembled by slip-sleeve or injection molded couplings overcomes these disadvantages. The talk was followed by the showing of a film on the installation of Tenite ground lead line systems and disposal well tubing.

SPI Divisions Meet

THE immediate and future military requirements for plastics film, sheeting, and coated fabrics were discussed in a special meeting at the Commodore Hotel, New York, N. Y., January 5, by representatives of the Office of the Quartermaster General, the Philadelphia Quartermaster Depot, and members of the SPI Plastics Film, Sheetng & Coated Fabrics Division. William T. Cruse, SPI executive vice president, noted that the Society has taken steps to coordinate the plastics requirements of the Armed Forces within the productive capacity of the plastics industry.

John R. Couture, of the Office of the Quartermaster General, emphasized that it is its policy to use materials based on their merits and, wherever possible, to adapt commercially produced vinyl film, sheeting, and coated fabrics to military requirements. Vinyl film raincoats and ponchos used in the last war had the problem of mildew, but this is now close to being solved. Dr. Couture also mentioned that vinyl sheeting is now being used for upholstery in officers' quarters.

Lt. Col. R. M. Denny, also of OQG, said that there is a use for vinyl film for packaging purposes, especially for small packets issued to troops. Some progress is being made in the study of toxicity in connection with the packaging of food, and the Office is also surveying the pos-

(Continued on page 583)

Scientific and Technical Activities

Rubber Division, A. C. S., Washington Spring Meeting

THE fifty-eighth meeting of the Division of Rubber Chemistry, American Chemical Society, will be held in Washington, D. C., February 28 and March 1 and 2. The headquarters will be at the Hotel Shoreham, where all the technical meetings will be held in the main ballroom. The opening session will begin at 2:00 p.m. on Wednesday, February 28, and there will be a morning and an afternoon session on both Thursday, March 1 and Friday, March 2. J. H. Fielding, Armstrong Rubber Co., chairman of the Division, will preside.

There will be no preregistration. Registration will take place from 7:00 to 9:00 p.m. on Tuesday evening, February 27, and continue through the following three days from 9:00 a.m. to 6:00 p.m. in the west lobby of the Shoreham.

This hotel will probably not be able to accommodate all guests attending the meeting in Washington, but the Wardman Park Hotel, which is but one block away, has also been selected as an official hotel and will take care of the overflow from the Shoreham.

A special feature of the meeting will be a symposium on Thursday afternoon, March 1, on the subject of "Current Rubber Problems," at which there will be talks by Earl Glen, of the National Production Authority, Arthur Wolf, of the National Security Resources Board, and Warren Stubblebine, Office of the Quartermaster General, Department of the Army.

The luncheon-meeting of the 25-Year Club is scheduled for Wednesday noon, February 28, in the Louis XVI Room of the Shoreham. Ernest R. Bridgewater, E. I. du Pont de Nemours & Co., Inc., and Harry L. Fisher, National Research Council, are in charge of this event.

The banquet of the Division will be held in the Terrace banquet room of the Shoreham on Thursday, March 1, at 7:00 p.m. John T. Cox, Jr., is handling banquet arrangements.

The local Washington Rubber Group is in charge of the arrangements for the meeting, and Norman Bekkedahl, National Bureau of Standards, is general chairman, assisted by Mr. Stubblebine as adviser. Other members of the local committee are T. A. Werkenthin, Bureau of Ships, registration; R. E. Harmon, Connecticut Hard Rubber Co., finance; Dr. Cox, banquet; T. R. Scanlan, Gates Rubber Co., publicity; R. D. Stiebler, NBS, hotel arrangements, and Ethel Levene, Bureau of Ships, ladies' program.

Members are urged to bring their wives to the Washington meeting, and Miss Levene has arranged an excellent program for them. There will be no registration fee for the ladies unless they attend the technical sessions, and they will pay only for the specific events in which they participate. The ladies will be able to attend a concert of the National Symphony Orchestra with Leopold Stokowski conducting. There will be visits to the embassies, with tea at the British Embassy. A fashion show-luncheon and a banquet for the ladies are being planned, also several sightseeing trips.

A letter to Division members including hotel and banquet reservation cards was sent out late in January.

In addition to the symposium on Thursday afternoon, the technical program is made up of 28 papers. The first session on Wednesday afternoon consists mostly of papers on carbon black and the physics of rubber. The Thursday morning session includes papers on other compounding ingredients, silicone rubber, reclaimed rubber, and the results of a comprehensive study of tire tread wear, as influenced by type of rubber and carbon black, as conducted by Office of Rubber Reserve in collaboration with carbon black producers. A paper on a new method of tread wear evaluation is also part of this second session. The Thursday afternoon session is the symposium on "Current Rubber Problems" as mentioned previously.

Papers for the Friday morning session cover aging methods and results and analytical methods used in the analysis of various rubbers. The final session on Friday afternoon consists of papers dealing with physical methods of test and the polymerization of synthetic rubbers.

Program and Abstracts of Papers

WEDNESDAY AFTERNOON—FEBRUARY 28

12:00 p.m.—25-Year Club Luncheon.
Louis XVI Room, Shoreham Hotel.

Main Ballroom, Hotel Shoreham
J. H. Fielding, Presiding

2:00 p.m.—1. Introductory Remarks.
J. H. Fielding, Chairman.

2:10 p.m.—2. Sorption of 41 and 122° F. GR-S Type Polymers with Carbon Blacks.¹ June Duke, W. K. Taft, Government Laboratories, University of Akron, Akron, O., and I. M. Kolthoff, University of Minnesota, Minneapolis, Minn.

The bound rubber-black complex formed by milling various polymers and carbon blacks at various temperature levels was studied. Contrary to previous reports, it has been shown that as the quantity of black in the mixture is reduced, the sorption per unit of black increases. The temperature of mixing likewise has a large effect—at lower carbon black loadings, higher temperatures increase the amount of sorption; the effect is minimized as the loading is increased until at high loadings (100 to 125 parts of black per 100 parts of rubber) this effect is eliminated.

EPC and HAF type blacks are essentially similar in their general behavior in forming this complex; whereas HMF and acetylene blacks form less of the complex under equivalent conditions.

The higher molecular weight polymer has been shown to be sorbed preferentially by the black. Dilute solution viscosity measurements, variations in Mooney viscosity of the raw polymers, fractiona-

tion of polymers into their high- and low-molecular weight fractions, and determination of the molecular weight distribution of the sol portion of the black-rubber mixtures have been used to demonstrate the selective sorption of the black for the material of high molecular weight in the polymer.

The effect of conversion of GR-S polymerized at 41 and 122° F. was also studied, but the results are not conclusive. They indicate that variables other than conversion have been encountered in the polymers, or that conversion is not an important factor. No definite relation between the temperature of polymerization of the polymer and the amount of sorption by the black has been shown.

2:35 p.m.—3. The Influence of Adsorption by Carbon Black on the Oxidation of Unvulcanized Cold Rubber. C. W. Sweitzer and F. Lyon, Columbian Carbon Co., Brooklyn, N. Y.

Previous investigations have shown a large difference between the amount of rubber insolubilized by carbon black in dilute solvent systems and in standard mill mixes. The purpose of this study, after reconciling these extremes, was to evaluate the role of adsorption in the insolubilization of rubber in mill-mixed compounds.

Since adsorption of cold rubber from dilute benzene solution is reversible with a small negative temperature coefficient, efforts were made to remove reversibility by decreasing solvent. Evaporation to dryness was required to attain irreversibility. Under this condition adsorption increased sharply, and the temperature coefficient became positive. Heating of this rubber-carbon film residue to temperatures in the range of those employed in mill mixing raised the level of adsorbed rubber to that of the level of insolubilized rubber in mill mixed compounds. This increase is associated with a sharp drop in the intrinsic viscosity of pure polymer when treated under similar conditions.

Varying the temperature and atmosphere treatment on this residue led to an indication of the influence of carbon black on the oxidation of cold rubber. Under conditions where scission dominates, as indicated by intrinsic viscosity results, i.e., in air below gel-forming temperatures and times, carbon black was found to repress the scission reaction. Under conditions where cross-linking dominates, i.e., either in air at high temperature or in nitrogen (traces of oxygen) at low temperature, carbon black was found to repress the aggregative processes. The evidence suggests that the role played by carbon black is the removal of oxidized intermediates by which the scission and gelation reactions proceed.

When the temperature treatment in air on this residue is carried to the point where cross-linking is sufficient to gel the rubber, the presence of carbon black represses this gel formation to varying degrees, depending on the type and the loading of the carbon. Non-carbon pigments show only a slight repression of gel formation. A degree of correlation has been found between these results and those ob-

¹ The work reported herein was carried out under the sponsorship of ORR, Reconstruction Finance Corp., in connection with the government synthetic rubber program.

served with mill-mixed stocks, suggesting the use of this approach to predict the behavior of carbon in rubber compounds.

3:00 p.m.—4. **The Autoradiographic Technique with Carbon-14 in Rubber.**
A. D. Kirshenbaum, C. W. Hoffman, A. V. Grosse, Research Institute of Temple University, Philadelphia, Pa.

Research studies sponsored by Lee Rubber & Tire Co., Conshohocken, Pa., have demonstrated the advisability of isotopic techniques in studying carbon black dispersions in rubber.

The uniformity of dispersion of carbon black in rubber is at present determined from the tensile strength, elongation, and modulus values. But low modulus, elongation, or tensile strength values are also caused by polymer breakdown. The method used in this paper to study the distribution of carbon black in rubber was a visual observation of the carbon black dispersed in the rubber. This visual observation was made possible by the autoradiographic technique using carbon-14.

Carbon-14, an isotope of carbon, is chemically identical with the carbon of the black; its only difference is that it has a higher atomic weight and is radioactive.

Autoradiography is a technique by which radioactivity present in a material may be precisely located. This technique utilizes Becquerel's discovery that radioactivity affects the photographic emulsions producing a blackening of the film. By making use of this technique, a trace of radioactive carbon (carbon-14) was incorporated into the carbon black to be used. The radioactive carbon black was then dispersed into the rubber. Samples of cured and uncured rubber containing the radioactive carbon black were put into direct contact with X-ray film, and after a suitable exposure time the films were developed. The radiations given off by the radioactive carbon blackened the films producing patterns. These patterns on the film are pictures of carbon black as distributed in the rubber.

The carbon-14 was incorporated into the carbon black by six different methods. None of these methods had any effect on the particle size of the carbon black. The best method of incorporating the carbon-14 into the carbon black was that of heating the carbon black with radioactive carbon dioxide ($C^{14}O_2$) at 900–1,000° C. Autoradiographs were taken of the carbon black containing the carbon-14, using Kodak "No-Screen" X-ray film and Ansco "Non-Screen" and "Superay A" X-ray films.

Good and bad carbon black-rubber mixes containing carbon-14 were prepared having tensile strength varying from 300–3,300 p.s.i. Autoradiographs of cured and uncured samples of these different mixes showed visible variations in the carbon black distribution which agreed closely with the tensile strength data. A comparison of these autoradiographs with microphotographs of the same samples showed that the autoradiographic technique was a better method than the microphotographic technique for studying the dispersion of carbon black in rubber.

3:25 p.m.—5. **Differentiation between Carbon Blacks by Electrical Resistance of Vulcanizates.** **J. E. McKinney and F. L. Roth, NBS, Washington.**

A study was made of the resistivity of vulcanizates containing GR-S synthetic rubber and various types of carbon blacks. The method used for measuring the electrical resistance was a modification of ASTM Method D991-48T. The modification was in the electrical circuit to permit the measurement of electrical resistances up to 1,000 megohms. When proper

care was exercised to prevent flexing of the specimens after curing and before testing, the coefficient of variation for resistivities of identical vulcanizates prepared on different days was found to be about 10%.

Resistivity decreased with time of cure, rapidly for undercures and slowly for overcures. For cures where strain tests were possible, the resistivity decreased with time of cure, according to the equation $(R-R_\infty)/(t-t_0) = 1/k$. This equation is of the same form as that relating strain and time of cure.

It was found that the resistivities of vulcanizates containing EPC black were at least 30 times as great as those of vulcanizates containing MPC blacks from the same manufacturer. The strain values for the same vulcanizates showed little difference. Relatively large differences, however, were found for resistivity of vulcanizates containing channel black of the same type, but made by different firms.

Six HAF blacks made by different manufacturers were studied. Vulcanizates of five of the blacks had resistivities within a twofold range. Vulcanizates of the sixth black differed markedly from the others.

It is concluded from these studies that resistivity can be used as a criterion for differentiating between different types of blacks and for detecting variations between lots of the same type.

3:45 p.m.—6. **Transmission of Mechanical Vibrations through Various Rubbers.** **R. E. Morris, R. R. James, H. L. Snyder, Mare Island Naval Shipyard, Vallejo, Calif.**

The purpose of this investigation was to determine how various natural and synthetic rubbers in compression compare with regard to transmission of mechanical vibrations when these rubbers have been compounded to have the same static modulus.

A piezoelectric transducer was used to generate vibrations of any desired frequency in the audio range. An identical transducer was used as a detector. The rubber specimen being tested, in the form of a right cylinder, was compressed axially to exactly 20% deflection between the opposing faces of the two transducers. The whole assembly was held together by a vise in the form of a heavy steel yoke.

The generating transducer was caused to vibrate in its longitudinal direction by applying alternating current at 300 volts to the crystals. The voltage produced in the detecting transducer by the vibrations was read from a vacuum-tube voltmeter. As a separate experiment, the phase angle between the voltage in the generating transducer and the voltage in the detecting transducer was measured on a cathode ray oscilloscope.

It was found that measurements of transmission could not be made at higher frequencies than 2,000 c.p.s. because mechanical resonances occurred in the apparatus which caused great apparent increases in transmission.

The voltage generated in the detecting transducer by the vibrational force passing through the test specimen was used as the basis for comparing the rubbers. It was assumed that the amplitude of vibration of the generating transducer remained constant over the frequency range and was the same for all rubbers. It was also assumed that the detecting transducer produced a voltage proportional to the vibrational force acting on it.

The rubbers tested were *Hevica*, Neoprene FR, Neoprene GN-A, Neoprene RT, Neoprene W, GR-S, X-453, X-454,

X-455, Paracril 18-80, Paracril 26-90, Hycar OR-25, Hycar OR-15, GR-I 25, and "Thiokol" ST. The X rubbers were a butadiene polymer and butadiene copolymers obtained from ORR.

All the rubbers were compounded with semi-reinforcing furnace black; the quantity of black added to each rubber was adjusted so that its vulcanizate had exactly the same static modulus in compression as the other vulcanizates. The Shore hardness of the vulcanizates ranged from 47 to 53.

Natural rubber was found to transmit less force than any of the other vulcanizates over the range of frequencies from 25 to 2,000 c.p.s.; moreover its transmissibility was essentially constant over this range of frequencies. Neoprene FR transmitted a little more force than natural rubber. Its transmissibility also remained practically constant over the frequency range except for a rise at low frequencies. The transmissibility of the other vulcanizates increased with rising frequency over the entire range. The greatest increases in transmissibility over the frequency range were obtained with Hycar OR-15 and GR-I 25.

The neoprenes as a group had less transmissibility than the butadiene polymer and copolymers. Paracril 18-80 had the least transmissibility of the latter vulcanizates. "Thiokol" ST transmitted a little more vibration than Paracril 18-80.

The foregoing statements about transmissibilities apply to the dynamic moduli of these rubbers because transmissibility and dynamic modulus were directly related under the conditions of these tests.

The coefficients of internal viscosity of the various rubbers were calculated on a relative basis and were found to decrease in every case with increasing frequency.

4:15 p.m.—7. **Statistical Mechanics of Rubber.** **F. W. Boggs, United States Rubber Co., Passaic, N. J.**

It is usually assumed that rubber is formed of a network of chain molecules which do not interact except through cross-links by which they are bound together. It is apparent that this assumption cannot be true because the density of rubber is comparable to that of liquid hydrocarbons.

It is shown in this paper that the methods of statistical mechanics applied successfully to the study of liquids can be appropriately modified to describe in a satisfactory way the behavior of rubber. The cell theory of Lennard-Jones and Devonshire gives expressions similar to those obtained by Guth and James with the difference that it is unnecessary to make any special assumptions to explain the incompressibility of rubber. More generally it is shown that a plausible explanation of embrittlement can be obtained if we assume a potential of mean force between the molecules of the type used by Kirkwood and his associates. A detailed calculation of the modulus of rubber as a function of temperature is given, and it is shown that the theory predicts a sharp increase in the modulus at low temperature.

THURSDAY MORNING—MARCH 1
Main Ballroom—Shoreham Hotel
J. H. Fielding, Presiding

9:00 a.m.—8. **Banbury Mixing of Zinc Oxide.** **H. C. Jones and E. G. Snyder, New Jersey Zinc Co., Palmerton, Pa.**

A surface treated zinc oxide has been evaluated in a laboratory Banbury mixing cycle with several types of GR-S, natural rubber, GR-I, butadiene-acrylonitrile and neoprene polymers. The investigation con-

sisted of the measurement of power consumption, pigment dispersion, and Mooney plasticity of 60-40 zinc oxide-rubber batches prepared by an "upside down" mixing procedure.

The propionic acid-treated pigment required somewhat less power for incorporation in the several polymers than the untreated base oxide characterized by a high electrical peak load during the initial stages of the mixing cycle. This feature would be a distinct practical limitation where there is danger of exceeding utility company demand rates for electric power. There was a substantial improvement in the pigment dispersion in the several polymers resulting from the presence of the surface treating agent. When stearic acid was introduced into the Banbury with the untreated oxide, the initial power surge was minimized, but the effect was much less pronounced than with the treated oxide, and the pigment dispersions were in the same order. Apparently the carboxyl group in the fatty acid is responsible for the lower power requirement and enhanced dispersion since the incorporation of a non-polar material, such as paraffin, with the zinc oxide did not alter the properties of the untreated oxide.

In 60-40 rubber-zinc oxide masterbatches premasticated natural rubber and GR-S broken down for 30 minutes on a laboratory mill were essentially equal and required less power for mixing than the low-temperature polymerized GR-S. Neoprene and GR-I consumed about the same quantity of power for mixing as did natural rubber and standard GR-S. The acrylonitrile polymer was stiffer and needed more power for mixing than the other polymers.

With a constant mixing cycle and cooling water temperature of 50, 65, and 80° C. less power was consumed at the higher Banbury temperatures, but there was a corresponding sacrifice in the dispersion of the untreated zinc oxide. When rotor speeds of 35, 69, and 135 r.p.m. were investigated, power consumption progressively increased. The best dispersions were developed at the intermediate speed, and poorest dispersion at 35 r.p.m.

9:20 a.m.—9. Studies on Improving Silicone Rubber. A. C. Glime, N. A. Duke, C. M. Doede, Connecticut Hard Rubber Co., New Haven, Conn.

The polymethylsiloxane elastomers are by far the most promising replacements for hydrocarbon rubbers for high or low temperature service. These silicone elastomers "alone" do not have physical properties sufficiently outstanding to make them considerable as possible substitutes for hydrocarbon rubber. However, when the silicone polymer is compounded with a reinforcing filler and cured with a suitable cross-linking agent, its physical properties are retained through a much wider temperature range.

It was felt that an investigation of the reinforcing properties of a wide variety of pigments and curing agents was necessary in order to ascertain if the physical properties of silicone rubber could be improved by a thorough compounding study of the silicone elastomer. The pigment survey included some 50 materials which were compounded with silicone gum (General Electric 9979-G) in various loadings. The pigments used included various types of silica, diatomaceous earths, calcium carbonates, metal oxides, and reinforcing blacks. This investigation indicates that stocks with tensile strength of 600-800 pounds per square inch at 50-100% elongation and Shore A durometer of 70 may be obtained.

A few pigments were pretreated by heating to high temperatures and at high vacuum to remove adsorbed materials and were later coated with silicone films.

Many aliphatic compounds have been tested as dispersing agents for the silicone gum-pigment system, with most of them acting as plasticizers or inhibiting the curing reaction rather than functioning as dispersing agents.

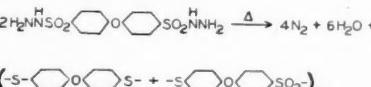
Other organic compounds including peroxides have been investigated as possible replacement for benzoyl peroxide as a curing agent in silicone rubber, but of these only tertiary butyl benzoate has given cures comparable to those obtained with benzoyl peroxide.

This study presents the current views on the subject of reinforcement of the silicone gum and the methods used in enhancing the physical properties of the silicone elastomer.

9:40 a.m.—10. Sulfonyl Hydrazide Blowing Agents for Rubber and Plastics. B. A. Hunter and D. L. Schoene, U. S. Rubber, Naugatuck, Conn.

Organic sulfonyl hydrazides have been found to be effective non-discoloring, non-staining blowing agents for rubber and plastics. The blowing efficiency of these substances is high, and they produce a fine, even-cell structure within the blown product. The preferred compounds of the group are non-toxic and produce no odor in the cellular product. These compounds are stable under normal storage and mixing conditions, but decompose smoothly at practical blowing temperatures for both rubber and plastics. These compounds, moreover, are substantially neutral substances and have little or no effect on the stability or the cure rate of the polymers into which they are introduced. The latter factor is of considerable importance inasmuch as a careful balance between rate of cure and rate of blow must be maintained for satisfactory production of certain types of sponge. In their overall properties the sulfonyl hydrazides offer practical advantages over many of the inorganic and organic blowing agents now available.

The gas-forming mechanism in the decomposition of organic sulfonyl hydrazides involves an internal oxidation-reduction of the sulfonyl hydrazide group. Nitrogen gas is copiously evolved, and a neutral organic residue remains. Water vapor is also produced. Although odorous decomposition products are formed with the simpler members of the group, modifications of the molecule are possible which make the decomposition products odorless. This condition is accomplished by using a difunctional compound which yields a polymeric product on decomposition. The preferred material is p,p'-oxy-bis(benzene sulfonyl hydrazide). This material decomposes smoothly at 140-160° C. according to the postulated mechanism:



The fact that the residue is polymeric is demonstrated by ignition of the dry powdered blowing agent. No flame is observed, but the material gasses off smoothly, leaving an expanded polymeric foam reminiscent in form and action of the well-known "Pharaoh's Serpents."

p,p'-oxy-bis(benzene sulfonyl hydrazide) has been shown to be a non-staining, non-discoloring, non-toxic, odorless blowing agent of considerable merit. It yields either open or closed cell expanded products according to the processing tech-

nique employed. Both rigid and flexible foams may be produced. It is generally applicable in a wide variety of rubbers including *Hevea*, reclaimed rubber, and the various synthetic rubbers as well as synthetic resins such as polyvinyl chloride, polystyrene, polyethylene, and the like. Typical recipes and processing techniques, including both mill additions and plastisol formulations, are described.

10:30 a.m.—Cure Studies of Some Aromatic Aldehydeamines. W. B. Shetterly, Naval Research Laboratory, Washington.

Twenty-four aldehydeamines have been examined as accelerators for GR-S standard compounds. The primary purpose of these investigations was to correlate the effect of minor structural variations in accelerators with some of the physical properties imparted to GR-S rubber compounds.

These accelerators may be classified with regard to the aldehydes employed in their synthesis. The four aldehydes; benzaldehyde, cinnamaldehyde, p-dimethylaminobenzaldehyde, and p-diethylaminobenzaldehyde, were each reacted with ethylene diamine, trimethylene diamine, hexamethylene diamine, diethylene triamine, triethylene tetramine, and tetraethylene pentamine. When possible, the reaction products were purified to give crystals or powders in preference to oils or resins.

The results indicate that the activities of the accelerators increased with those aldehydeamines containing more amine nitrogen. The faster cures were obtained with cinnamaldehyde and p-diethylaminobenzaldehyde compounds than with the corresponding amine products of benzaldehyde, and p-dimethylaminobenzaldehyde.

Although mercaptobenzothiazole and heptaldehyde aniline were faster accelerators and required lower concentration than the aldehydeamines under consideration, optimum cures could be obtained with 2.0 or 2.5 parts of aldehydeamine accelerator with 100 parts of GR-S hydrocarbon.

The reduction in ultimate elongation due to oven aging and oxygen bomb aging was much less in the case of the aldehydeamine compounds examined than with compounds accelerated with mercaptobenzothiazole or heptaldehyde aniline (Hepten base).

10:20 a.m.—12. The Rate of Cure of Present-Day Whole Tire Reclaimed Rubber. J. M. Ball and R. L. Randall, Midwest Rubber Reclaiming Co., East St. Louis, Ill.

Present-day whole tire reclaimed rubber (neutral process) containing a blend of natural rubber and GR-S hydrocarbon has been tested in two series of compounds. The first series consists of four compounds: a natural rubber control and three others each with a different reclaim, viz., mixed elastomer neutral process, natural rubber alkali process, and natural rubber neutral process. The second series consists of three compounds: A GR-S control, one containing the mixed elastomer reclaim, and one in which one-half of the GR-S is replaced with the mixed elastomer reclaim on an equal RHC basis.

All compounds were designed to contain the same RHC by volume; the adjustments were made by the addition of FF black and Paris White, which are essentially neutral to cure.

The various tests are:

1. Mooney scorch at curing temperature. This work was done in the Midwest laboratory and also in an outside cooperating laboratory.

2. Stress-strain and tensile. Data were plotted against time of cure. The optimum

times chosen are those corresponding to or approaching the maximum tensile range.

3. Energy capacity calculated according to the method of Sheppard. The data were plotted against time of cure, and the optimum curing times were read off as in the case of tensile data.

4. Relaxed compression set. Conditions of test were: 35% deflection for two hours at 212° F., plus one hour relaxation at 212° F. Data were plotted against time of cure, and the curing times at constant compression set values were tabulated.

5. Elongation at constant load. Data were obtained at 200 p.s.i. and 400 p.s.i. on the NBS strain tester and plotted against time of cure. The curve is a rectangular hyperbola from which scorch time and curing rate were calculated. Then from these two values a preferred time of cure was determined, using the method recently developed by Schade. These strain data were obtained only on the first series of compounds.

Summary of results follow:

1. With comparable compounds natural rubber reclaim tends to cure faster than the natural rubber control.

2. The alkali-process natural rubber reclaim tends to cure faster than the neutral-process natural rubber reclaim.

3. The mixed elastomer neutral-process reclaim tends to cure more slowly than the natural rubber control.

4. The mixed elastomer neutral-process reclaim cures considerably faster than the GR-S control.

5. The blend of GR-S and mixed elastomer reclaim also cures considerably faster than the GR-S control.

6. Compression set data do not rate the compounds in the order just given. They are valuable, however, as a precise means of duplicating a given state of cure, or of comparing different compounds at equal states of cure.

7. Values for preferred time of cure from strain data lead to ratings of the compounds in the natural rubber series which are in substantial agreement with those arrived at from energy capacity optimums.

8. Nothing in the present results contradicts results obtained by previous workers.

10:40 a.m. — 13. **Tread Wear of Tires**—Influence of Type of Rubber and Black. J. Mandel, M. N. Steel, R. D. Stiehl, NBS.

Road test results are presented for treads made from four rubbers and seven blacks. The rubbers are GR-S, GR-S-10, GR-S X-485 (cold rubber), and *Hevea* Ribbed Smoked Sheets. The blacks include acetylene, EPC, three makes of HAF, and two makes of RF. The results presented are part of an extensive study of rubbers and carbon blacks conducted by ORR in collaboration with the carbon black producers. The road tests were made over a period of 15 months by the government tire test fleet in the vicinity of San Antonio, Tex. The design of the test and the analysis of the tread wear data were made by NBS.

Tread wear was measured both by measurement of tire weights and of depths of tread grooves. The advantages and disadvantages of each method are presented together with an analysis of the precision of road tests. The design of test makes differences in tread wear of 3.5% for rubbers and of 9% for blacks significant although the coefficient of variation of individual measurements is approximately 20%.

It was found that the effect of type of rubber on tread wear was not affected by the type of black with which it was

compounded and that the effect of type of black was not affected by the type of rubber. Thus the rubbers and blacks could be rated independent of each other. The rubbers fell in the following order with respect to increasing rate of tread wear: GR-S X-485, *Hevea*, GR-S, and GR-S-10. The blacks fell in four distinct groups. The three HAF blacks were in the same group, and treads containing them wore the least. Treads containing acetylene black wore by far the most. Good agreement was obtained between the observed wear values for individual treads and values calculated from average wear values for the rubber and for the black in the tread.

Besides rating the rubbers and blacks, the effects of vehicle, wheel position, aging, and climatic conditions were determined. It was found that despite the lower rate of wear on front wheels, reliable wear ratings could be obtained using all four positions if the data were averaged geometrically instead of arithmetically. Storage for one year caused an appreciable increase in tread wear. The effect of climatic conditions was indeed startling. Certain rubber-black combinations wore better in winter than in summer; some wore better in summer than in winter, and the wear of others were not significantly affected by climatic conditions.

11:05 a.m. — 14. **Analysis of Non-Skid Loss Mileage Data in Tread Wear Evaluations.** D. G. Stechert and T. D. Bolt, Gates Rubber Co., Denver, Col.

The rate of wear of a tire in service depends primarily on the design of the tire, the properties of its components, and the conditions to which it is subjected in service. This statement implies that problems of tire design and development are quite complex as must be well realized by those engaged in this type of work.

The degree of success that can be achieved in tire development will, to a certain extent, depend on the availability of a simple and reliable method of analyzing experimental measurements of tire wear. In fact, great value would lie in having a method that could serve as an industry standard.

Commonly, it has been the practice to use as a tire rating the last measurement of miles per thousandth inch of tread wear in a tire test. The practice has a definite disadvantage in that considerable value is placed on the last measurement; all measurements prior to the last are disregarded. Such a rating, furthermore, may be unreliable since it may vary with mileage.

A method has been developed in which all experimental measurements of non-skid depth taken during a test run are incorporated in a single rating of tread wear for each tire tested. The rating can be based on either the loss in non-skid depth at a constant mileage or the miles to tire baldness. Essentially the method consists of the utilization of a certain functional relation between non-skid loss and mileage.

The proposed method of analysis has been used successfully for more than two years. It has been applied to a large variety of test tires without a single denial of the method. The technique has been used to obtain tread wear ratings of both passenger and truck tires in sizes ranging from 6.00-16 to 10.00-20, of tread designs of various types, of tires produced by different manufacturers, of tread stocks from widely different formulations, of various levels of tire quality, and of tires tested either on controlled fleet tests or on uncontrolled field service tests.

With respect to former common practice, the application of the proposed method of analysis of tire wear measurements can result in more reliable tread wear evaluations and more economical utilization of a tire test fleet and can allow a more rapid turnover of ideas. Test fleet economy can be realized by testing tires until only about half of the non-skid is worn off and then extrapolating to baldness by means of the above-mentioned functional relations.

11:25 a.m. — **Business meeting.**

THURSDAY AFTERNOON—MARCH 1
Main Ballroom—Shoreham Hotel
J. H. Fielding, Presiding

2:00 p.m.—Symposium on “**Current Rubber Problems:**”

Synthetic Rubber—Past and Present.
E. W. Glen, deputy director, rubber division, NPA, Washington.

Preparedness in Rubber. A. Wolf, chief, rubber division, NSRB, Washington.

The Army's Need of Rubber-Like Materials. W. Stubblebine, research director, chemistry and plastics section, Office of the Quartermaster General, Washington.

7:00 p.m.—**Division Banquet.** Terrace Banquet Rooms, Shoreham Hotel.

FRIDAY MORNING—MARCH 2
Main Ballroom—Shoreham Hotel
J. H. Fielding, Presiding

9:00 a.m.—15. **Lignin Reinforced Nitrile, Neoprene, and Natural Rubbers.**
J. J. Keilen,² Polytechnic Institute of Brooklyn, and W. K. Dougherty and W. R. Cook, West Virginia Pulp & Paper Co., Charleston, S. C.

Lignin, available as a by-product of the sulfate process for pulping wood, can be coprecipitated over a wide range of loadings with butadiene-acrylonitrile, neoprene, or natural rubber as well as GR-S to give good reinforcing of these elastomers. Vulcanizates of coprecipitates containing between 50 and 100 pounds of lignin per 100 pounds of nitrile rubber of 26% acrylonitrile content give tensile strengths of 3,200 p.s.i., tear resistance from 200-400 pounds per inch, Shore hardnesses from 75 to 95, in combination with 300% moduli of 700-900 p.s.i. and elongations of 600-700%. At the 50-pound loading the tensile strength is 150 p.s.i. higher than with EPC black of the same volume loading, i.e., 38.5. At double this volume loading, equivalent to 100 pounds of lignin, the tensile strength exceeds that obtained with EPC by 800 p.s.i. Other carbon blacks and the inorganic pigments give lower values than does EPC.

In neoprene, a maximum tensile strength of 2,400 p.s.i. is found at a coprecipitated lignin loading of 50 pounds per 100 pounds of rubber, equivalent to 48 volumes of lignin per 100 volumes of rubber. Other properties of the coprecipitated lignin vulcanizates at this loading are 300% modulus, 1,100 p.s.i.; elongation, 200%; Shore hardness, 96; and crescent tear resistance, 190 pounds per inch. At both 48- and 96-volume loadings, tensile strengths obtained with coprecipitated lignin are between those obtained with SRF, HMF, or EPC blacks and the inorganic pigments. Coprecipitated lignin develops only low tear resistance and low elongation in neoprene.

Vulcanizates of coprecipitated lignin and natural rubber have tensile strengths of 4,000 p.s.i. at a loading of 50 pounds per

² Present address, West Virginia Pulp & Paper Co.

100 pounds of rubber. Other properties at this loading are 300% modulus, 1,100 p.s.i.; elongation, 700%; Shore hardness, 70; and tear resistance, 360 pounds per inch. At a lignin loading of 100 pounds per 100 pounds of rubber, a tensile strength of 2,600 p.s.i. is developed, with Shore hardness of 90, and tear resistance over 500 pounds per inch. At both of these loadings coprecipitated lignin gives higher tensile strengths than any other pigment, including the carbon blacks, at the same volume loadings. In comparison with other pigments in natural rubber, lignin behaves as it does in GR-S and nitrile rubber, giving low modulus, high elongation, and good tear resistance.

9:25 a.m.—16. **Method for Evaluating the Dynamic Fatigue of Adhesion of Tire Cords to Rubber Stocks.** W. J. Lyons, Firestone Tire & Rubber Co., Akron.

A practical, reasonably quick method for evaluating the resistance of the adhesive bond between tire cord and rubber stock to flexural (dynamic) fatigue has been developed. The method employs the "Roller-Flex" machine, on which the test cords, cured in rubber and under tension, are subjected to rapid, cyclic flexure by being passed back and forth around small steel rollers. The resistance of the adhesive bond to dynamic fatigue is evaluated by a measurement of the cord adhesion by the familiar "H" pull-out test, after the sample has been flexed on the machine for a selected period. The dynamic adhesion thus measured is compared with the "H"-adhesion value of unflexed (static) specimens of the sample.

It has been shown that there is a continual decline in cord adhesion as the flexing period is prolonged, and that in most dipped rayon samples, evidently, the sharpest decline occurs during the first six or eight hours flexing. On the basis of these results, 10 hours was selected as the flexing period in the standard test. Statistical analysis shows that, in general, the uniformity of results within a sample fixes a difference of six pounds per inch in specific adhesive force, between samples, as necessary for significance at the 5% level. Dynamic adhesion measurements by this method have been found to correlate reasonably well with tire endurance in such fleet-test data as were available and applicable to this problem.

9:45 a.m.—17. **Migration of Materials during Accelerated Aging by the Oxygen Pressure Method.** M. B. Fackler and J. S. Rugg, Gates Rubber.

The oxygen pressure method of accelerated aging has been well established among the testing techniques employed in rubber technology. Despite general acceptance it has been found from practical experience that reproducibility of results must be constantly sought and is not always easily obtained.

Many workers have pointed out certain aspects which must be controlled in order to apply successfully the data obtained from the bomb. This paper points out another aspect of oxygen aging technique which must be recognized and controlled if reliable and reproducible results are to be obtained.

This paper shows that when a heterogeneous group of stocks is aged in a single bomb, some phenomenon occurs which affects test results. This condition can be explained by migration of materials from one sample to another during the aging period. The migrating material acts to change the apparent resistance of the stocks in the bomb. The apparent resistance to oxidation may be increased or de-

creased, depending on the nature of the migratory material.

This study investigated the migratory effect of various quantities of sulfur acceleration, and antioxidant. Data shows that aging high sulfur stocks together with normally oxidation resistant stocks reduces the resistance of the latter.

Conversely, aging of high antioxidant stocks together with stocks of poor or mediocre oxidation resistance results in improvement in resistance of poorer stocks.

The oxidation resistance of a "sulfur less" type of curing combination can be seriously deteriorated by placing it into a bomb with high sulfur stocks. On the other hand, a gum stock which melts, when aged alone, shows measurable physical properties remaining after heating in a bomb with a stock containing an antioxidant. The magnitude of such changes in apparent oxidation resistance are sufficient to be grossly misleading.

This study was carried out with both gum- and tread-type stocks. A similar trend is noted in each, and the magnitude of change is essentially the same for both types of formulations.

Data point out the need of careful consideration whenever stocks are placed together in the oxygen bomb. The most reliable test conditions prevail when separate bombs are used for individual stocks.

The net result of this work indicates that testing laboratories and agencies preparing specifications for rubber products should seriously consider the use of individual oxygen bombs as a means of obtaining a more reliable estimate of oxidation resistance.

10:05 a.m.—18. **Non-Destructive Rubber Aging Tests.** R. F. Shaw and S. R. Adams, Rock Island Arsenal, Ordnance Corps, Department of the Army.

The evaluation of aged rubber materiel, such as tires, has shown that the conventional physical measurements of tensile, elongation, and hardness cannot be correlated with service life and oven aging tests. Outdoor aging tests have shown that changes in tensile and hardness may increase for one year or two years and then decrease. The presence of ozone cracks in stressed rubber has been shown to have a far greater influence on service life than changes in physical properties due to oxidation alone.

As a result of this study on aged rubber materiel, it became apparent that a need existed of an aging test which gave good reproducibility and was suitable for use in evaluating the effects of the various aging media such as ozone, oil, oxygen and the circulating air oven on rubber specimens. The most desirable method would be non-destructive, i.e., readings could be made on the same specimen at definite time intervals and would express the result as a numerical quantity.

As a means of evaluating the extent of ozone cracks, a T-50 type specimen made of an electrical conductive GR-S composition was stretched in a fixture, and exposed to ozone, and the reduction of the cross-sectional area, as evidenced by the increase in volume resistivity, was measured electrically as the cracks developed.

A mechanical method of determining the extent of cracking was to remove the stretched T-50 specimen from the ozone chamber and to measure the increase in elongation caused by suspension of a weight on the reduced cross-section. This may be considered a reverse modulus measurement since it is the elongation caused by a given load rather than the load required to produce a given elongation.

The NBS strain tester is an instrument well suited for determining the elongation produced by a given load such as 100, 200, or 400 p.s.i. The advantages of measuring the extensibility of rubber at elongations below the elastic limit and at practical elongations from the end-use viewpoint are inherent in this apparatus.

The use of the same specimen for repeated measurements after various exposure intervals gives reproducibility of data that no other aging test can attain.

Illustrations of the test equipment and typical data are shown: (1) tensile, elongation, hardness of failure vs. non-failure tires; (2) typical ozone cracked tire; (3) outdoor exposure tensile, elongation, hardness properties; (4) volume resistivity apparatus; (5) resistance vs. time curve (ozone); (6) T-50 stretch apparatus; (7) % elongation vs. time curve (ozone); (8) NBS strain tester; (9) % elongation vs. time curve (ozone); (10) % elongation vs. time curve (air oven @ 158° F.); (11) % elongation vs. time curve (air oven @ 212° F.).

10:25 a.m.—19. **Application of Infrared Spectrographic Methods in the Study of Ozone Deterioration of Rubber and Elastomeric Materials.** I. J. Stanley and A. R. Allison, New York Naval Shipyard, Brooklyn.

Although the physical effects of ozone attack of rubber-like materials are readily apparent, the chemical changes associated with this type of deterioration are not clearly definable.

Techniques are described for obtaining infrared spectrograms of ozonized raw polymers of the following types: *Hevea*, GR-S, GR-I, Neoprene W, and nitrile type. Spectrograms are presented representing different degrees of ozonization of each polymer type. The spectrograms are discussed in terms of indications of comparative structural changes occurring in the respective polymer molecules undergoing ozonization.

While relative rates of accumulation and depletion of various structural linkages are shown on a semi-quantitative basis, some discussion is given to aspects of the investigation suggesting possible applicability of more rigid quantitative techniques.

The work described is part of a program having as its ultimate objective the development and investigation of improved methods for the evaluation of elastomers in the compounded, cured state.

10:50 a.m.—20. **New Method for the Quantitative Analysis of the Natural Rubber Hydrocarbon.** Rachel J. Fanning and N. Bekkedahl, NBS.

The quantitative analysis of the rubber hydrocarbon in natural rubber is determined by measurement of the refractive index of a solution of a known weight of acetone-extracted rubber in a known weight of solution. For this study the solvent used was alpha-bromonaphthalene.

The procedure is based on the assumption of a linear relation between the refractive indices of the solutions of various concentrations and the volume percentage of rubber hydrocarbon in the solution. It also assumes that all material remaining in the acetone-extracted rubber, the rubber hydrocarbon, is insoluble in the solvent. These assumptions seem reasonable and appear justified by the results of measurements made on a great number of samples of natural rubber, including plantation rubbers, purified rubber, and a variety of wild rubbers. In all cases the results were checked against values obtained by the method of chromic acid oxidation and in some instances were also

compared with the results obtained by the rubber bromide method and the method of differences.

The method is not applicable to rubbers which have been vulcanized, nor can it be used where there are mixtures of synthetic and natural rubbers. Its chief use would be in the analysis of crude natural rubbers. The precision of the method, as developed to date, is probably no greater than that of other methods, but the procedure is simpler and does not require so much of an operator's time. It is believed that the precision of the method can be improved by the use of a more suitable solvent, e.g., one that has a refractive index value differing more from that of rubber hydrocarbon than that of alpha-bromonaphthalene.

11:10 a.m.—21. Determination of Rubber Hydrocarbon by an Improved Bromination Method. W. J. Gowans and F. E. Clark, United States Department of Agriculture, Salinas, Calif.

Previous published investigations have shown that in the bromination of rubber, addition is accompanied by some substitution. Experimentally determined factors for converting rubber bromide to rubber hydrocarbon have varied from 0.285 to 0.292; whereas the theoretical factor for a completely additive product is 0.2988. The substitution portion of the bromination reaction is very difficult to control and has contributed in the past to low results and occasional poor precision.

Our study reveals that the addition of chloroform to the benzene solution of rubber, for all practical purposes, prevents the substitution reaction from taking place with no apparent effect on the addition reaction. The liberation of hydrogen bromide, an indication of substitution, is almost completely stopped. Explanation of the mechanism of the inhibition effect of chloroform is beyond the scope of the present paper. However a conversion factor of 0.299 is obtained for *Hevea* smoked sheet, which agrees well with the theoretical value. A conversion factor of 0.301 is obtained for guayule rubber, which may or may not indicate that guayule rubber hydrocarbon is slightly more saturated than *Hevea*.

Conversion factors are determined by two methods: (1) the ratio of the weight of purified rubber hydrocarbon to the weight of rubber bromide prepared from the purified rubber hydrocarbon, and (2) the analysis of rubber bromide for bromine content. The two methods agree well with each other.

The effect of rubber hydrocarbon concentration on the bromination reaction is investigated and shown to be critical. Iodine accelerates bromination, but is not present in the final product. Temperature and light are important variables, as might be expected in this type of reaction. The bromination reaction is quite insensitive to bromine concentration as long as a considerable excess is present. Trichloroacetic acid in the amounts used to assist in the solution of crude rubber has no effect on the results.

The bromination method of determining rubber hydrocarbon is briefly compared to the chromic acid method, which has received considerable attention by industry.

Finally, a recommended procedure is presented in detail which, if rigidly followed, yields accurate and precise results.

11:30 a.m.—22. Viscosities of 0.25 to 90% GR-S Rubber Solutions. A. B.

Bestul, H. V. Belcher, F. A. Quinn, C. B. Bryant, NBS.

The flow behaviors of solutions of the butadiene-styrene synthetic rubbers GR-S X-518 and GR-S X-588 in alpha-methyl-naphthalene have been measured over the entire concentration range. Less complete measurements on the system GR-S X-518 in cetane are presented with the above data. As well as showing the variation of flow behavior with concentration over the entire concentration range, these results provide a comparison between the behaviors of solutions of rubbers having different polymerization temperatures (GR-S X-518, 50° C.; GR-S X-588, 5° C.).

Viscosities of 10, 30, 50, 70, 90, and 100 weight per cent. (rubber) solutions were measured with a McKee worker-consistometer.³ These measurements were made on all three systems at 40° C. and on only the two alpha-methylnaphthalene systems at 50° C. Viscosities of 0.25, 1, 5, and 10 weight per cent. (rubber) solutions of the two alpha-methylnaphthalene systems were measured with Bingham viscometers at 30° and at 40° C.

Solutions having concentrations of 10% or less were prepared by placing weighed quantities of rubber and solvent in cylindrical glass jars and rolling them until the components appeared homogeneous. Most of the solutions having concentrations of 10% or more were prepared in an internal mixer consisting of a stainless steel chamber containing two motor-driven S-shaped blades rotating in opposite directions, thereby thoroughly masticating and blending the components placed in the chamber. The chamber was continuously swept with helium during mixing. The chamber was first charged with 90% rubber and 10% solvent; this charge was mixed; a weighed quantity of the 90% solution was removed; additional solvent was added to the chamber in the proper amount to give a 70% solution; this charge was mixed, and the removal of solution—addition of solvent procedure was repeated successively to produce the 50, 30, and 10% solutions.

The present results agree with the known behavior of polymer solutions at the two ends of the concentration range. The change of viscosity with concentration decreases markedly and monotonically with increasing concentration. The slope of a log viscosity versus concentration plot is about 100 times smaller at 100% rubber than at 0% rubber.

The data support unpublished findings of this laboratory and other laboratories that as the polymerization temperature of a rubber is lowered, the flow behavior of its dilute solutions becomes more nearly Newtonian.

FRIDAY AFTERNOON—MARCH 2
Main Ballroom—Shoreham Hotel
J. H. Fielding, Presiding

2:00 p.m.—23. Determination of the Physical Properties of Natural and Synthetic Rubber Materials at Low Temperatures. J. Z. Lichtman and C. K. Chatten, N. Y. Naval Shipyard.

The physical and chemical properties of vulcanizates under low-temperature service conditions have received and will continue to receive considerable attention from manufacturing and procurement agencies. The effective study of these properties is dependent on the use of accurate and reproducible evaluation procedures and suitable instrumentation. A program of study of the many procedures and devices used by private and government agencies for the evaluation of elasto-

meric compounds is being carried out at the Material Laboratory, New York Naval Shipyard.

Among the physical properties most frequently studied for indications of change in the compound due to low temperature exposure are stiffness and hardness. The devices used for evaluation of stiffness or change of stiffness include flexural and torsional deformational instruments; while all the hardness measuring instruments are essentially indentometers utilizing either constant or variably loaded indentors. Following a comprehensive preliminary program of evaluation of numerous flexural and torsional deformational and indentation instruments, the correlation between modulus, expressed as flex modulus, and indentation was investigated, using instruments which had shown a high degree of accuracy and freedom from frictional and other errors and which were also found to possess desirable operational characteristics. The instrument used in determining the flex modulus properties was a Gehman torsional tester modified to facilitate either long-time exposure and operation in a low-temperature conditioning chamber, or short-time exposure evaluation by immersion of the mounted specimen in a dry ice-methanol bath. The indentometer used was a constant load instrument conforming in basic respects either to Federal Specification ZZ-R-601a or to British Standard 903-40. Frictional effects in the instrument were reduced to a minimum by suspending the major load on a concentric extension of the indicator shaft during the loading period.

The elastomer compounds used included neoprene, GR-S, Perbunan-26, *Hevea*, Butyl, "Thiokol" FA, Silicone, polybutadiene (122° F polymerization temperature), polybutadiene (14° F. polymerization temperature), sodium catalyzed polybutadiene, sodium catalyzed butadiene-styrene (75-25), butadiene-styrene (85/15, 122° F. polymerization temperature), and butadiene-isoprene-styrene (85/8/12, 41° F. polymerization temperature). The Gehman torsional data were used to evaluate the flex moduli of the elastomer materials on the basis of Trayler and March's analysis of the torsional deformation of rectangular cross-sectional members. The indentation data were correlated with the calculated flex moduli and showed close agreement with Scott's analysis of the indentation-modulus relations of a spherically tipped constant load indentometer. The indentometer, as modified to comply with British Standards, showed a straight line relation between modulus proportionality factors calculated on the basis of Scott's equation,

$$E = \frac{A}{H^{1.35}}, \text{ and moduli of elasticity evaluated}$$

using the Gehman torsional tester. Although this analysis was made using data obtained at 75° F. only, further investigations conducted, after conditioning specimens for 94 hours at temperatures down to -50° F. and using the indentometer modified to conform to FS ZZ-R-601a, showed an indentation-modulus relation as expressed by the equation

$$E = \frac{A}{H^{1.36}}, \text{ where } E \text{ is in p.s.i. and } H \text{ in}$$

mm., the moduli of elasticity again was calculated by means of the Trayler-March and analysis on the basis of the modified Gehman instrument data. The latter equation was determined on the basis of hardness indentation data ranging from 0.10 mm. to 1.70 mm. and moduli of elasticity ranging from 350 to 20,000 p.s.i.

³ASTM Bulletin, 153, 90 (1948).

These investigations indicate the feasibility of use of either instrument to evaluate the stiffness or hardness properties of elastomers over the temperature, hardness, and modulus range indicated and the equivalence of the terms "stiffness" and "hardness" as defined by the respective procedures.

The use of specimens of small cross-sections, as required by the modified Gehman instrument, would facilitate the evaluation of changes in stiffness due to exposure to solvent and other media at normal, low, and elevated temperatures, justifying the slightly more complex procedure and mathematical analysis than that required by the hardness indentometer.

2:20 p.m.—24. Modulus and Relaxation of Elastomers in Torsion at Low Temperatures. W. E. Wolstenholme and M. Mooney, U. S. Rubber Co., Passaic.

Gum vulcanizates in the form of $\frac{1}{4}$ -inch rods were held twisted at low temperatures, and torque was measured over time periods extending to five months or more. The torque approached no limiting value other than zero, though torque was restored to near initial value if the sample was brought up to room temperature. The conclusion is drawn that all elastomers studied crystallize more or less, and the crystallization depresses the torque. The elastomers tested include 122° F. GR-S and Hycar, which have not shown crystallization in other tests.

A few samples were tested in cycles of temperature variation at constant twist. The shear modulus so measured obeys approximately the theoretical law of proportionality to absolute temperature; departures to lower modulus are observed as the temperature approaches second-order transition temperature, T_s . The measurements extend down to $T_s + 2^\circ C$, but there is no indication of the sharp modulus rise found in transient modulus measurements.

A Cold Bar, eight feet long, is described, containing constant temperature baths equally spaced in the temperature range from -70 to $2^\circ C$.

2:45 p.m.—25. Butadiene Polymers and Copolymers for Low Compression Set in Low Temperature Service. R. E. Morris, J. W. Hollister and F. L. Shew, Mare Island Naval Shipyard.

In the course of preparing Naval vessels to maneuver in the Arctic, the problem has arisen of providing rubber gaskets which recover rapidly from compression at temperatures as low as $-35^\circ F$.

Previous work has shown that regular GR-S is generally satisfactory for this application because its vulcanizates do not crystallize or undergo second-order transition at $-35^\circ F$. During the past several years ORR has made experimental polybutadienes and butadiene/styrene copolymers for evaluation by Defense Department laboratories. These rubbers have differed in polymerization temperature and, in the case of the copolymers, in styrene content. It was desirable to ascertain whether any of these experimental rubbers were better than GR-S for manufacturing gaskets for low temperature service.

The rubbers tested totaled 34. They were all compounded with the same recipe, and all stocks were given the same cure. The Mooney viscosities of the raw rubbers were determined. The vulcanized rubbers were tested at $82^\circ F$ for hardness and tensile properties and at $-35^\circ F$ for hardness and compression set. The latter tests were made after conditioning intervals of five and 94 hours at $-35^\circ F$. A previous investigation had shown that high

cold compression set correlates with poor sealing ability of gaskets at low temperatures.

The tensile properties and hardness at $82^\circ F$ of the vulcanizates were found to be influenced by the temperature of polymerization, the Mooney viscosity, and the styrene content of the respective raw rubbers; but the relations between these properties on the one hand and the characteristics of the raw rubbers on the other hand were not well defined. When polymerization temperature was the only variable, low polymerization temperature correlated fairly well with high tensile strength and increased hardness. When viscosity or styrene content was the only variable, a high value also correlated fairly well with high tensile strength and increased hardness.

The relations between compression set at $-35^\circ F$ on the one hand and polymerization temperature and combined styrene on the other hand were better defined. Smooth curves were obtained when the compression sets of rubbers having the same polymerization temperature were plotted against their contents of combined styrene. Sufficient points were obtained on some of these curves to show that they passed through a minimum for compression set as the styrene content was increased. Hardness at $-35^\circ F$ was not so amenable to treatment in this way because this property was found to be affected by Mooney viscosity as well as by polymerization temperature and combined styrene.

Six copolymers yielded vulcanizates having stable compression sets considerably lower than the compression set of the GR-S vulcanizate. The polymerization temperatures of these copolymers ranged from 86 to $145^\circ F$, and their contents of combined styrene ranged from 8.7 to 16.0%. All of these rubbers, except possibly the copolymer prepared at $145^\circ F$, would be better than GR-S for manufacture of gaskets for low temperature service.

3:10 p.m.—26. Amine Activators for 5° C. Emulsion Copolymerization Reactions. R. Spolsky, W. H. Embree, H. L. Williams, Polymer Corp., Ltd., Sarnia, Ont., Canada.

Polyamines such as diethylene triamine and tetraethylene pentamine have been shown to be promising activators for low-temperature polymerization reactions in emulsion using organic hydroperoxides as initiators.⁴⁻⁵ Further study of the use of these materials has uncovered several interesting effects.

An extensive study of the use of diethylene triamine and tetraethylene pentamine in the copolymerization of butadiene and styrene showed that mixtures of the two polyamines yielded attractive results. Tetraethylene pentamine alone tended to cause a rapid initial rate of reaction after which the reaction died out. Diethylene triamine tended to show very slow rates of reaction which speeded up. Combination of the two from about 3:1 to 1:3 gave the highest overall conversion in a standard reaction cycle of 17 hours at $5^\circ C$.

The addition of ferrous sulfate to the tetraethylene pentamine-type activator resulted in still more rapid rates of polymerization, after which the reaction quickly died, evidently from exhaustion of the initiator system. The addition of ferrous sulfate to the diethylene triamine-type activator resulted in greatly enhanced rates of polymerization. However, mixed diethylene triamine and tetraethylene pentamine activators containing as little as 0.0028-part of ferrous sulfate heptahydrate for 0.15-part of polyamines and 0.2-part

cumene hydroperoxide per 100 parts of monomers seemed to exhaust the catalyst system before high conversions were reached. The effect of the ferrous sulfate could be eliminated by the addition of ethylene diamine tetraacetic acid and, as shown earlier,⁵ could be minimized by the inclusion of sugar in the recipe. When larger amounts of the polyamines were used, the rate of conversion of hydrocarbons to rubber was less dependent upon the amount of hydroperoxide present. A fatty acid-type soap yielded faster rates of conversion than did a rosin acid type.

It was of interest to compare the previous data⁴⁻⁶ with those obtained in the copolymerization of butadiene and acrylonitrile. It was observed in the latter case that the amines gave very poor results. Since the redox system itself could not have been altered, it is evident that acrylonitrile was interfering in some way with this redox system, perhaps by cyanoethylation of the amines. Of the amines tested o-phenanthroline was the best activator. The addition of ethylene dinitrilo tetraacetic acid did not improve the overall conversion appreciably. However, as shown earlier for butadiene-styrene systems, the addition of digested dextrose or other source of enediol was beneficial, and in the case of butadiene-acrylonitrile the effect was more striking. The addition of one part on the monomers of digested dextrose increased the conversion in 17 hours from 10 to 70% for tetraethylene pentamine activator. Evidently in some manner the dextrose was able to conserve the free radicals in the system so that polymerization could be effected. The amine-type activators were, however, effective at higher temperatures in the absence of sugar and in the presence of exceedingly small amounts of amines.

The amines reacted very readily with acrylonitrile in alkaline aqueous solution. The primary amines seemed to react slightly more rapidly than tertiary or secondary. The amount of acrylonitrile reacting with the amines could be reduced if dextrose were present in the solution or if the medium were acid. Between one mol and two mols of acrylonitrile were consumed per mol of amine present.

3:35 p.m.—27. The Reactivity of Butadiene in Emulsion Copolymerization at $5^\circ C$. C. C. Walling⁷ and J. A. Davison, U. S. Rubber, Passaic.

The compositions of synthetic rubbers derived from butadiene have been studied. Monomer reactivity ratios have been determined for the copolymerization of butadiene with methyl methacrylate, methyl acrylate, butyl acrylate, methacrylonitrile, and vinylidene chloride in emulsion at $5^\circ C$. In the copolymerization of butadiene with acrylate esters there is a tendency toward alternation. Butadiene is shown to behave much like styrene in copolymerization. Styrene therefore serves as a substitute for butadiene in oil-phase polymerizations, where the polymerization of butadiene is inconveniently slow.

4:00 p.m.—28. Polymerization of 2,3-Difluorobutadiene and 2-Chloro-3-Fluorobutadiene. L. B. Wakefield, Firestone.

The polymerization of butadiene in the past has led to the preparation of a number of highly interesting materials. The polymers have excelled in cold resistance and in recent times have shown good tread

⁴Whitby et al., *Ind Eng. Chem.*, 42, 445, 452 (1950).

⁵Spolsky, Williams, *Ibid.*, 42, 1847 (1950).

⁶Mitchell, Spolsky, Williams, *Ibid.*, 41, 1592 (1949).

⁷Present address, Lever Bros. Co., Cambridge, Mass.

wear; in general, they left much to be desired with respect to processibility, solvent resistance, and tensile strength. Chlorine-containing butadienes have shown considerable improvement in these properties, but at the expense of cold resistance. The problem of developing polymers with improved cold resistance and a minimum loss in other properties turned toward fluorine-containing monomers in view of the lower melting point of fluorine compounds in comparison with their chlorine analogs.

The literature contains several references to fluorine-containing elastomers. An intensive study of the polymerization of 2-fluorobutadiene has been made in this country. The polymers had a better balance of oil resistance and freedom from low temperature stiffening than did polychlorobutadiene controls. The polymerization of 2-chloro-3-fluorobutadiene was claimed by W. Bock in a German patent, but only general polymer characteristics were mentioned; cold resistance and tensile properties were not discussed. These data confirmed the interest in fluorine-containing dienes in the present study.

Two monomers were of particular interest: 2,3-difluorobutadiene and 2-chloro-3-fluorobutadiene. The symmetrically placed fluorine atoms of the former were expected to favor a definite geometrical configuration in the monomer which would lead to a high degree of crystallinity in the polymer, but it was recognized that the weak polarity and small bulk of the fluorine atoms might give rise to relatively small inter-chain forces and low second-order transition points. The replacement of one fluorine atom by chlorine was expected to give a polymer very much like polychloroprene in tensile strength and cold resistance, yet with added solvent and ozone resistance.

It was found that 2,3-difluorobutadiene polymerized to give a tough, leathery material which was very poorly processible, especially in black stocks. Its gum tensile with a sulfur cure was very low, of the order of 400 p.s.i. Copolymers with styrene and butadiene could be formed, but only the butadiene copolymer was rub-

bery and could be mixed. Its gum tensile was lower than that of the homopolymer, but in a black stock it had a tensile of 2,250 p.s.i. It was outstandingly superior to GR-S in its ozone resistance, but its low temperature stiffening point was considerably higher.

The polymer of 2-chloro-3-fluorobutadiene closely resembled that of chloroprene in nearly every property studied, with the sole exception of low temperature behavior. In this property it stiffened at a temperature 18 degrees above polychloroprene.

4:20 p.m.—29. **Measurement of the Refractive Index of Elastomers.** A. Arnold, I. Madorsky, L. A. Wood, National Bureau of Standards.

The measurement of the refractive index of solid elastomers is discussed, with particular reference to GR-S rubber and the use of an Abbe-type refractometer. A detailed procedure is described by which each specimen is first purified by extraction or other means, dried in a vacuum oven, and then pressed between aluminum foil at 100° C. at a pressure of from 50 to 300 p.s.i. After pressing and cooling, the aluminum foil is removed from one side of the specimen. A strip $\frac{1}{8}$ -inch wide is cut from the specimen and placed on the refractometer prism, and readings are made. Common sources of error are discussed, such as non-uniformity of the sample, incomplete extraction, oxidation, improper pressing and cutting of the sample on the refractometer, inaccuracies in the refractometer, and temperature control. Methods of eliminating these errors are given.

A detailed study has been made of the precision and accuracy obtainable with GR-S polymers using an Abbe-type refractometer with an incandescent light source. It was found that the standard deviation corresponding to intrinsic variability of the method was 0.00007.

Several applications of the use of refractive indices both in research and in process control are listed. One important application is the current use by government synthetic rubber plants for the determination of bound styrene in GR-S.

all graduates of the University and prominent in the life of Akron for many years. They are Maurice A. Knight, president of the chemical stoneware company bearing his name; Hal G. Knight, head of the Rubber City Sand & Gravel Co.; and Mrs. Robert Iredell, wife of the director of engineering of General Tire & Rubber Co.

Dr. Simmons expressed his thanks to the family of Curtis J. Harwick for a gift of \$25,000, to be used in equipping the rubber and plastics laboratories, and to H. Muehlstein & Co., for a gift of \$10,000 for the purpose of establishing the Julius Muehlstein award of \$350 a year to a deserving student in the field of rubber chemistry.

The president of the University then unveiled a portrait of Dr. Knight painted by Lulu Knight, who was introduced and talked about her grandfather.

After brief talks by Architect M. P. Lauer and Builder Carl Clemmer, Lee R. Jackson, president of the Firestone Tire & Rubber Co. and a graduate of the University's chemistry course in 1913, presented the key of the building to Ernest H. Cherrington, dean of the liberal arts college, and Walter A. Cook, head of the chemistry department. Jackson, a director of the University and chairman of the building committee, pointed out that it was fitting that Akron should have the best possible facilities for the study and teaching of chemistry since it is the rubber capital of the world. Nearly half of the University's 316 chemistry graduates serve the rubber industry, he said.

A symbolic key to the new laboratory was presented to the community by Cletus G. Roetzel, chairman of the board of directors of the University, and was accepted by Mayor Charles E. Slusher. A similar key was presented by Dr. Simmons to all of the secondary schools of the area and was accepted by Vernon S. Culp, chemistry teacher at Akron West High School.

Greetings of other Ohio educational institutions were expressed by Paul H. Fall, president of Hiram College and himself a prominent member of the American Chemical Society. G. E. P. Smith, Jr., of Firestone and chairman of the Akron Section, A. C. S., voiced the congratulations of the chemical profession in the Akron area.

At the close of the building dedication ceremonies, Dr. Walter F. Tunks, of St. Paul's Episcopal Church, gave benediction.

Brief exercises were then held at the east entrance of the building, during which a bronze plaque in the lobby was dedicated to the memory of Curtis J. Harwick, a university alumnus who organized the Harwick Standard Chemical Co. Webster N. Jones, of Carnegie Institute of Technology, spoke at the exercises.

After conducted tours of the Knight Laboratory building, dinner was served in the dining room of the student building, preceding the evening program. Harry P. Schrank, chemistry graduate in 1924, director of the University, and vice president of Seiberling Tire & Rubber Co., presided at the evening program. The principal speaker, Dr. Fisher, was introduced by his former associate, Harlan F. Trumbull, assistant director of research of the B. F. Goodrich Co.

Among the more than 300 guests present at the dedication was the Hon. Ali Sastroamidjojo, ambassador of the Republic of Indonesia to the United States. The ambassador and D. Basuki, commercial counselor of the Indonesian embassy in Washington, were introduced during the afternoon program by W. D. Coerr, of the United States Department of State's division for Indonesian affairs.

University of Akron Knight Laboratory Dedication

PROMINENT rubber chemists, educators, and community leaders took part in ceremonies dedicating the new \$750,000 Knight Chemical Laboratory at the University of Akron, Akron, O., during the school's Founder's Day celebration January 18.

The spacious four-story laboratory, of white brick construction, is named in honor of Charles M. Knight, professor of chemistry from 1875 until 1913. The new building replaces the old Knight Hall, opened in 1909, in which the first course in rubber chemistry in the world was started by Dr. Knight in the same year.

Highlight of the dedication program was an address by Harry L. Fisher, internationally known rubber chemist, of the National Research Council, Washington, D. C. Dr. Fisher spoke on "Rubber Plus Chemistry". The speaker reviewed the history of the development of rubber chemistry and technology over the years with references to Priestly, Hancock, Macintosh, Faraday, Reithofer, and Luedersdorff abroad, and Goodyear and Hayward in this country in the early days. Dr. Fisher then mentioned the work of the

modern chemists in developing organic accelerators and antioxidants, chemical derivatives of rubber, and the most recent work on synthetic rubbers. He also mentioned that synthetic rubbers have been made, but only in small quantities, that have hysteresis values equal to and even lower than natural rubber, and that it now appears only a matter of time before these new synthetic rubbers will be available in larger quantities for further study.

This speaker also stressed the important contribution already made by the University of Akron to the rubber industry in its training of many rubber chemists and expressed the wish that the new Knight Laboratory would give new impetus to rubber research, particularly in connection with synthetic rubber.

The dedicatory program opened in the afternoon with an address of welcome by H. E. Simmons, president of the University and head of its chemistry department from 1913 to 1933. Dr. Simmons told of his student days under Dr. Knight and of the decisive part the latter played in his turning to a career in chemistry. He also introduced Dr. Knight's three children,

Breckley, Hendricks Speak

THE Ontario Rubber Section, C.I.C., held a joint dinner-meeting with the Kitchener-Waterloo Branch, C.I.C., on January 9 at the Granite Curling Club, Kitchener, Ont., Canada. Approximately 100 members and guests of the two groups attended the meeting, which featured a talk by J. Breckley, Titanium Pigment Corp., on "Titanium Dioxide," and a talk by J. G. Hendricks, National Lead Co., on "Stabilization of Polyvinyl Chloride Type Resins."

Mr. Breckley's talk covered the occurrence and chemistry of titanium, as well as the production and properties of titanium metal and titanium dioxide. Titanium dioxide occurs in three forms; the two best known are anatase and rutile. There are three known processes for producing titanium dioxide, but the normal commercial method is known as the sulfate process wherein the ore is digested with sulfuric acid, and after an exothermic reaction, a dry mass is obtained. This substance is dissolved; the hydrous oxide is removed after hydrolysis and then calcined to titanium dioxide. Since titanium dioxide has a slightly basic pH, it is slightly activating in a rubber compound. The rutile form is superior to the anatase in retaining its whiteness after sun exposure. Since they are easily flocculated by alkalies, the water dispersible forms of Titanox are not desirable for use in latex, but the stable dispersions of the non-water dispersible types are satisfactory when a wetting and dispersing agent is used. In plastics as in rubber the rutile grades appear to be superior to the anatase form.

After reviewing the theories of degradation of polyvinyl chloride resins, Mr. Hendricks discussed stabilizer systems, the selection of which is a critical step in the development of a vinyl plastic product. The speaker noted that there is no one best stabilizer or stabilizer system for all vinyl compounds because the other components or compounding ingredients used can influence stability to a very marked degree. The speaker concluded by discussing the properties of a number of stabilizers.

SORG Party, Officers

THE Southern Ohio Rubber Group held its annual winter meeting and Christmas party on December 16 at the Miami Valley Golf Club, Dayton, O. The meeting began with a dinner at 7:00 p.m., followed by the distribution of favors and door prizes, and concluded with an evening of dancing and card games. Each lady attending received a leather billfold as a gift, and each man received one of the door prizes made possible by the contributions of 71 rubber and supplier companies.

Results of the recent mail balloting for new officers and directors of the Group were announced, as follows: chairman, Louis J. Keyes, Dayton Rubber Co.; chairman elect, Jack E. Feldman, Inland Mfg. Division, General Motors Corp.; secretary, Russell J. Hoskin, Inland; treasurer, Frank E. Newton, Dayton Rubber; and directors, R. B. Appleby, E. I. du Pont de Nemours & Co., Inc., R. R. Hickernell, Inland, and William Whitaker, Herren Bros. & Meyer, Inc. Other directors of the Group are Joseph Rockoff and R. S. Radow, both of Dayton Rubber; K. S. Karch, C. P. Hall Co.; John M. Walsh, Xylos Rubber Co.; Mr. Feldman; George Lang, Pioneer Rubber Co.; and R. B. Sucher, Inland.

SPI Divisions

(Continued from page 574)

sibility of using waterproof vinyl bags and packages.

L. Boor, of the development laboratory, Philadelphia Quartermaster Depot, stated that work on the elimination of attack by living matter that feeds on the vinyl plasticizer has progressed to the point where fungus growth can be stopped. Work is also in progress on stopping bacterial attack, and when these problems have been solved, the department will be in a position to write specifications for vinyl film, sheeting, and coated fabrics. Mr. Boor noted that arctic shelters covered with vinyl coated duck are now in actual use, and specifications are being drawn for a vinyl coated nylon poncho.

Tentative drafts of standards for general vinyl film and unsupported upholstery material will be made available shortly, according to Charles L. Condit, SPI technical secretary. These standards, which include test methods and limiting values, will be circulated to all companies in the Division before being submitted to the United States Department of Commerce for promulgation into a commercial standard.

Reinforced Plastics Conference

The SPI Reinforced Plastics Division will hold its sixth annual technical session February 28 to March 2 at the Edgewater Beach Hotel, Chicago, Ill. There will also be a display of new and unusual products and product components developed from reinforced plastics in conjunction with the meeting.

Subjects to be discussed at the conference include what is new in Fiberglas pre-forming; basic mold design; bulk fillers; merits of the plastic tote box; starting a reinforced plastic business; new developments in the field of resins; horizons in appliances; machining and finishing of reinforced plastic parts; safety engineering; current situation in plastic raw materials; and others. An important feature will be a panel discussion on government agencies' requirements, with speakers from the Quartermaster General's office, Navy Aeronautics Bureau, Navy Bureau of Ships, Army Engineer's Board, and the Air Materiel Command.

New Polyco Emulsion for Resilient Flooring

POLYCO 1673-37B polyvinyl acetate co-polymer emulsions, for use in overcoming brittleness and inadequate resistance to grease and solvents in resilient flooring, has been announced by American Polymer Corp., Peabody, Mass. By varying the content of resins and the type or fineness of fillers in the composition, the new product permits the laying of different types of floors since the plasticity of the emulsion solids influences the degree of flexibility and resilience of the flooring. These emulsions are available in a wide range of properties, with variations in solids content, molecular weight, particle size, particle charge, and viscosity.

Expands Oleic Acid Output

THE emergency expansion of oleic acid production to meet increased trade demand and government requirements has been announced by Emery Industries, Inc., Carew Tower, Cincinnati 2, O. This increase is in the form of a new single distilled product, Emersol 212 Elaine, similar to Emersol 210 Elaine except for a 4% maximum unsaponifiable content and a 96% minimum free fatty acid content. Corresponding specifications for Emersol 210 are 2.5% and 97%, respectively.

This deviation of the new product from normal quality will have only minor effect on many finished products. For these cases and where availability is paramount, the new Emersol 212 Elaine is recommended. Production of the new material supplements the company's line of regular, high-quality, and premium-grade oleic acids. Samples of Emersol 212 Elaine may be obtained from the company or from its branch offices and representatives in New York, N. Y., Lowell, Mass., Philadelphia, Pa., San Francisco, Calif., Chicago, Ill., Detroit, Mich., and Cleveland, O.

New Standard for Melamine Tableware

The first commercial standard for melamine plastic tableware has been announced by the Commodity Standards Division, Department of Commerce. Effective immediately, the standard is identified as Heavy-Duty Alpha-Cellulose-Filled Melamine Tableware, Commercial Standard CS 173-50. The new standard, whose preparation was instigated by SPI two years ago, is aimed to maintain quality of melamine tableware while providing complete specification information for producers, distributors, and users.

The standard covers methods of test, materials, workmanship, thickness, finish, resistance to boiling water, resistance to dry heat, and other detailed requirements. An identifying hallmark has been included which can be used by manufacturers to indicate compliance with this standard. The methods of test are designed so that they can be conducted without costly equipment and by personnel that need not be specially trained.

Buffalo Group Elections

THE annual Christmas party of the Buffalo Rubber Group was held December 19 at the Elk's Club, Buffalo, N. Y., with some 150 members and guests attending. The program included a cocktail hour and dinner, followed by several vaudeville acts, and concluded with a drawing for many door prizes made available through the contributions of some 78 rubber and supplier companies.

Elections of officers and directors for the coming year were held during a brief business session, in accordance with the slate selected by the nominating committee headed by John Augenstein, U. S. Rubber Reclaiming Co. The following were elected: chairman, Paul Sick, Hewitt-Robins, Inc.; vice chairman, Fred Kohlhagen, Globe Woven Belting Co., Inc.; secretary-treasurer, Ray Lowry, Hewitt-Robins; and directors (for three years), T. T. McConnell, U. S. Rubber Reclaiming, and Fred Ball, Pierce & Stevens, Inc. Other directors of the Group are Glen Meyers, J. O. Meyers & Sons; Orin Ferster, Queen City Rubber Co.; and Bill Butler, Socony-Vacuum Oil Co.

NEWS of the MONTH

NPA Plans Specification Controls by March If GR-S Production Permits; Ingle GSA Rubber Director

The National Production Authority rubber division meeting with its Industry Advisory Committee, January 23, decided to institute standardizing regulations for rubber products by February 15 and specification controls by March 1, if possible. GR-S production did not reach its target in December and January, and any further losses might defer the installation of specification controls by March 1.

John B. Ingle, formerly with Good-year Tire & Rubber Co., was appointed director of rubber procurement by Jess Larson, General Services Administrator, on January 10. Information on the details how the government will handle the exclusive buying and distribution of natural rubber were expected by February 1 or shortly thereafter.

After a series of meetings with the Economic Stabilization Agency, tire manufacturers instituted price increases for original equipment passenger-car tires of 12.5% and for truck and bus tires of 17.5% on January 17. It was not clear whether these prices would be allowed to stand when the overall price-wage freeze, scheduled for late January for all business, was declared.

The matter of the basis for import duties on foreign rubber footwear was again introduced in Congress in the form of H. R. 1535, the Customs Simplification Bill. The industry is expected to continue its fight to prevent the use of the foreign instead of the American selling price for calculating the import duty.

Additional year-end statements by industry leaders were optimistic for a high rate of production during 1951 if adequate rubber and essential components were available.

John L. Collyer, president of The B. F. Goodrich Co., again called for restriction of the use of natural rubber by Atlantic Pact Nations, West Germany, and Japan, and the limitation or curtailment of natural rubber shipments to Russia and her satellites.

Washington Report

By

ARTHUR J. KRAFT

NPA Industry Meeting

NPA held a full-dress meeting with its Rubber Industry Advisory Committee on January 23, the first such meeting attended by the new rubber division director, Leeland D. Spencer. The meeting was devoted to a review of prospective supplies of natural and synthetic rubber, and agreement was reached on launching a thorough study of rubber conservation measures, beyond the scope of the present overall consumption ceilings.

On the following day a series of meetings was launched with representatives of 22 end-product segments of the rubber manufacturing industry to draw up recommendations for reducing the natural rubber content in products where natural rubber

is not technically necessary. Also envisioned is the elimination of natural rubber from non-essential products and the elimination of some non-essential rubber products. The discussions will encompass also the drafting of simplified manufacturing standards for some rubber products, such as passenger-car tires.

Although no dates are firm, NPA is aiming at February 15 as the target for instituting standardizing regulations, likely to take the form of prohibiting the use of new rubber in more than a single line, style, and type of passenger-car tire in a given size. Other rubber products may also be subjected to standardizing regulation. The white sidewall tire, for which pigments are now in short supply, is certain to be eliminated. Tire dealers several months ago had asked NPA for greater standardization of tires.

The target for specification controls is March 1, although this too will depend on how quickly NPA and industry can agree on a set of specification controls. The tire and the mechanical goods segments of the industry have already submitted recommended specifications based on natural rubber content, and NPA has its own specifications which reportedly are somewhat more stringent.

NPA revealed that the consensus of the meeting was that production of synthetic rubber will begin to meet production schedules of Rubber Reserve in March and continue to rise steadily thereafter. The committee was informed on the GR-S production outlook as well as the difficulties encountered in December and January by a Rubber Reserve official.

The press release on the January 23 meeting reported that "it was indicated" that NPA plans to separate the allocation of natural rubber latex from dry natural rubber beginning in March and that the use of the former may be reduced "somewhat" below the present 6,000 long tons a month rate.

NPA said also that it is likely that an increase will be required in the production of camelback for recapping tires. The agency also reported that it will undertake jointly with other interested government agencies a study to determine whether some of the natural latex being imported in liquid form can be converted to dry natural rubber in the Far East in such a way that the government will be assured of being able to purchase this rubber. The agency added that liquid latex is coming into this country in plentiful supply.

Reorganization and expansion of NPA's rubber division to handle its more complex series of controls await the availability of more office space and industry experts to fill various positions with the agency. Manufacturing concerns have been asked to designate certain of their employees for government service in the rubber defense program. Some of these organizational plans are expected to take shape in action in March.

More Lost GR-S Production

"Mechanical difficulties" and the weather were again advanced by NPA as reasons

for a loss of some anticipated production of synthetic rubber in January, necessitating a 17% cutback in authorized use of GR-S for the month.

This cutback was confirmed by NPA in a press release January 19, in which it reported that "about 100 companies are affected." Similar difficulties were reported by the agency as the reason for lost GR-S production in December, which was announced December 15.

At that time, the Reconstruction Finance Corp.'s public relations department gave assurances that the trouble would be cleared up in time to meet the January production target. It is still problematical, however, whether February's goal, reported unofficially at 45,000 tons of GR-S, will be met.

The RFC's Office of Rubber Reserve record for the past several months has shown its production lagging behind announced goals. Production targets for the past several months (with actual production figures in parentheses) ran as follows: November, 39,000 tons (35,000); December, 45,000 (39,000); January, 53,000 (45,000). One estimate put the reduced allowable total for civilian goods at 40,500 tons in January.

The uncertainty as to whether production bottlenecks will be overcome during the current quarter is an important element in NPA's consideration of whether to initiate specification controls pegged to natural rubber as early as March. When the first-quarter program came first under consideration, it was decided to hold off specifications until the second quarter. This decision was later abandoned in favor of holding off a decision on the March program until a clearer picture could be ascertained as to synthetic production and imports of natural rubber.

Alcohol Supply

Rubber Reserve's huge requirement for industrial alcohol to operate its reactivated butadiene plants at Kobuta, Pa., and Louisville, Ky., may result in bailing the administration out of the perennially embarrassing "potato problem."

At the request of ORR the United States Department of Agriculture last month renewed consideration of making alcohol from surplus potatoes, acquired through price support operations. The Department claims that it always has been willing to consider selling its potatoes to alcohol makers, but until recently it has been lukewarm toward the idea, preferring, instead, to convert some of the nation's huge grain surplus into alcohol.

What appeared to be huge grain surpluses only a few months ago, however, now are viewed as comfortable reserves, which should be maintained as a defense measure. The Department is opposed to diverting grain to uses other than food or animal feed.

On January 17, Secretary of Agriculture Brannan ordered an immediate halt to disposal of surplus potatoes in Maine, where some 12,000,000 hundredweight of the 16,000,000 hundredweight government surplus is located. At the same time the

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COLUMBIAN CARBON CO. • BINNEY & SMITH CO.
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MPC (Medium Processing Channel)
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EPC (Easy Processing Channel)
MICRONEX W-6

HAF (High Abrasion Furnace)
STATEX-R

FF (Fine Furnace)
STATEX-B

FEF (Fast Extruding Furnace)
STATEX-M

HMF (High Modulus Furnace)
STATEX-93

SRF (Semi-Reinforcing Furnace)
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COLUMBIAN CARBON CO.

MANUFACTURER

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Department opened negotiations with major distillers looking toward the sale of Maine's surplus for making alcohol for the rubber program.

The Department indicated its willingness to continue selling the potatoes at 1¢ per hundredweight and to load them on boxcars at an additional cost to the purchaser of 10¢ per hundredweight. The distillers balked at the latter condition and, with Rubber Reserve's support, have demanded that Agriculture absorb the 10¢ loading cost.

Agriculture contended that the law bars its assuming any cost in disposing of surplus potatoes exceeding the cost of destroying the potatoes, a few cents per hundredweight. One way out of this dilemma would be the assumption of the loading cost by ORR or some other agency, possibly the White House, which has contingency funds available for disbursement at the President's discretion.

A hundredweight of potatoes can be converted into one wine gallon of alcohol and, the distillers contend, sold to the government at 95¢ a gallon with normal profit included. This delivery cost is based on these conditions: sale of potatoes at 1¢ per hundredweight, absorption of loading cost by government, absorption of freight charges by the distiller (and reflected in his price) and alcohol producer relatively near the source of supply and ultimate use.

These conditions mean alcohol production in the New England area or as far south as Baltimore and Philadelphia, where the largest, readily available idle capacity is located. Freight charges from Maine are 50¢ per hundredweight to Philadelphia and 55¢ to Baltimore.

Agriculture officials reviewed the situation in late January meetings, and indications were they might attempt to deal with a number of small outfits instead of working out a deal with one or two major distillers.

Rubber Reserve, which has remained silent on the alcohol-from-potato issue, is reported still in the market for some domestic alcohol, although a contract with the French Government is scheduled to bring in about 10,000,000 gallons a month starting in January. The agency's requirement is estimated at 130,000,000 gallons or more for 1951, of which France has promised 112,000,000 gallons at about 57¢ a gallon cost to RFC, far less than the cost of domestic alcohol.

Benzene Supply

A task force of producers and consumers of benzene, acting as industry advisers to the NPA, has recommended to that agency that the government authorize facilities for the production of 88,000,000 gallons a year of synthetic benzene from petroleum to meet defense needs.

The committee recommended a goal of 280,000,000 gallons of benzene from all domestic sources for 1953, or about 300,000,000 gallons if imports continue from Western Europe at the current rate of about 20,000,000 gallons a year.

Demand in 1951, the committee estimated previously, would run about 220,000,000 gallons for all requirements, exceeding anticipated total supply by some 13,000,000 gallons.

Bruce K. Brown, head of the Petroleum Administration for Defense, told a press conference on January 5 that PAD, an Interior Department agency, was about to recommend "some" certificates of accelerated tax depreciation for benzene projects carried out by petroleum companies. The recommendations are to the National Security Resources Board, which makes



John B. Ingle

final determination on which defense expansions are permitted to take the rapid tax writeoff.

GSA Natural Rubber Activities

General Services Administrator Larson disclosed, in a statement to the press on January 9, that the government had asked rubber goods manufacturers with buying representatives in the Far East to move rubber out of that area at a "stepped-up" rate in order that deliveries would not be delayed. This request was made at a meeting held January 5 and presided over by A. J. Walsh, commissioner of GSA's Emergency Procurement Service, which is in charge of procuring strategic materials for the defense stockpile and buying for other natural rubber requirements as well under the exclusive buying system instituted December 29.

Larson's statement was prompted by rumors, which started in Washington on January 5, and came to fruition a few days later in a banner-headline story in a New York newspaper claiming that the government was anxious to evacuate American personnel from the rubber producing areas.

He made clear that the rumors, pegged on reported "trouble" in the Far East, a possible imminent effort by Red forces to take over Malaya as well as mount a whirlwind offensive in Indo-China, boiled down to no more than an effort to speed deliveries of natural rubber to assure adequate supplies here to meet current stockpile and consumption goals.

The GSA prior to assuming its role as exclusive purchaser of imported natural rubber started negotiations with the five major rubber goods manufacturers with buying facilities and representatives in the Far East, looking toward the signing of contracts whereby the companies would act as buying agents, on a strictly cost reimbursement basis, for GSA. These contracts were signed early in January, it has been unofficially confirmed.

GSA had promised to make available to manufacturers in the first quarter some 43,000 tons of "rotation" rubber from the stockpile and additional quantities out of February and March deliveries so that manufacturers would have available the approximately 110,000 tons of natural rubber, including latex, authorized for use in the quarter.

Deliveries on outstanding contracts negotiated prior to December 29 are expected to be adequate to fill a permitted consump-

tion allowance of 110,000 tons, or thereabouts. The March consumption limitation, however, had not been fixed by the NPA in late January. For January, 40,000 tons, including natural latex, were authorized for consumers, and 35,000 tons had been authorized for February. The expectation is that 35,000 tons, or perhaps less, will be authorized for March, possibly paired with some end-product specification controls.

Ingle GSA Rubber Director

Larson, in a press release dated January 10, announced that John B. Ingle will be director of rubber procurement for the government's exclusive rubber buying program, a responsibility of GSA's Emergency Procurement Service.

Mr. Ingle, who has more than 30 years' experience in all phases of the rubber industry, has since April, 1948, acted as a consultant for the purchase of rubber for the national stockpile.

Mr. Larson said the government is fortunate in obtaining the services of a man as able as Mr. Ingle in this highly specialized field.

Ingle began his career in 1916 with Goodyear. He has been resident director of the Crude Rubber Co. in Indonesia and has served in executive posts for the Goodyear company in British Malaya, Panama, and Costa Rica. During World War II he was production manager for the Goodyear Synthetic Rubber Corp. and until recently was assistant manager of Goodyear's crude rubber division.

Mr. Ingle is a native of San Diego, Calif., and a graduate engineer of Massachusetts Institute of Technology.

ODM Foreign Supplies Committee

Charles E. Wilson, Director of the Office of Defense Mobilization, issued his first order on January 19, creating a government Committee on Foreign Supplies and Requirements. This committee, he said, will assist him in improving "the coordination and effectiveness of federal policies and programs relating to foreign supplies and requirements."

William C. Foster, former Under Secretary of Commerce and currently ECA Administrator, was appointed chairman of the committee, whose membership will be drawn from 10 government departments and agencies.

The committee's function, Wilson said, "will be to gather information with respect to the requirements" of our foreign aid programs and to recommend program and policies to help this country obtain foreign strategic materials.

"On the basis of its findings, the Committee will advise Mr. Wilson on the allocation of materials and end-items to foreign countries as well as to direct these programs to assist in the procurement of strategic materials from abroad," according to an ODM press release accompanying the order.

Wilson pointed out that scarce materials are needed to support our foreign aid programs and to meet other essential needs of the free world. A "balanced approach to the problem must be made," he said, "so that the U. S. economy is adequately supported, while at the same time countries which supply us are helped to produce an increasing flow of strategic materials."

Membership of the committee will be drawn from the Department of State, Treasury, Defense, Interior, Agriculture, Commerce, and Labor as well as from

the ECA, Defense Production Administration, and GSA. W. Averill Harriman, special assistant to the President, is also a member.

AAA on Rubber Program

The American Automobile Association has raised its voice for unification of the government's rubber program in one agency. In an editorial, entitled "Too Many Cooks and Directives," appearing in the January issue of its official publication, *The American Motorist*, the AAA had this to say:

"The time has come for Uncle Sam, in the interest of efficiency, to unify all the rubber functions of the Federal Government under one agency. Such a step would go far toward giving us the kind of rubber program we need to face the uncertain days that lie ahead."

The editorial pointed that "no less than 10 Government agencies have a say on the rubber question."

Greater coordination of the rubber program is regarded generally as in the cards, but not necessarily involving the complete unification proposed by the AAA.

Generally, indications are that efforts are being made within government to establish improved liaison among the major agencies dealing with rubber, the NPA, RFC, and the GSA. NPA's new rubber director, Leland D. Spencer, has already held preliminary meetings with some other agency officials looking toward improved liaison.

The NSRB for some weeks has been studying possible steps to develop greater coordination of the rubber program, acting on the request of the Senate Armed Service preparedness sub-committee.

ESA Tire Price Actions

The Economic Stabilization Agency turned its attention to original equipment tire prices at a series of meetings running from January 4 through January 17, with six tire manufacturers.

The outcome of the meetings, as reported by an ESA official, was that the price and wage control agency neither approved nor disapproved tire price increases. He reported that the increases, ranging from 12.5 to 17.5%, "probably" were put into effect immediately after the January 17 meeting.

Whether they will remain in effect, or will be rolled back as a consequence of an across-the-board price freeze expected momentarily in late January, will be matter for lawyers to decide, he felt.

The situation developed as follows. Goodyear announced on December 15 that it would increase its prices on original equipment tires effective January 1. Shortly after, five other tire manufacturers followed Goodyear's lead and announced similar increases to start January 1.

The increases were reported by ESA to range from 12.5% on passenger-car tires to 17.5% on some truck tires. The National Association of Independent Tire Dealers, Inc., informed its members that they ranged from 12.5 to 17.5%, reporting also that the announcement by the tire companies prompted some marketers to increase prices on replacement tires. The manufacturers' action applied only to original equipment tires.

ESA secured a promise from the tire manufacturers to hold the price increases in abeyance, pending an investigation of their propriety. The investigation was begun at a meeting on January 4, continued the following day. The manufacturers met with Price Administrator Michael V.

DiSalle and ESA rubber, chemicals, and drugs consultant, George W. Strasser.

The meetings broke up with no conclusions reached and the manufacturers agreeing to submit cost data to ESA. The data were submitted prior to a meeting with ESA on January 16. Meanwhile the price increases were not put into effect and "hung over the market," according to Strasser.

ESA reported that DiSalle's special assistant, Edward F. Phelps, at the January 16 meeting, asked for an additional week to study the problem, but the industry representatives asked that he seek ESA approval by January 17. He stated that ESA officials were unable to make a decision on the basis of figures presented by the tire manufacturers. "The industry men agreed," ESA'S press release continued, "to meet individually with ESA Consultant George W. Strasser and furnish additional information about their companies operations before the January 17 meeting."

After this meeting, presided over by Phelps and attended by Strasser and ESA Tire Consultant Hubert H. Peterson, ESA issued the following:

"Price Stabilization Director Michael V. DiSalle today announced his office had concluded a series of meetings with representatives of the major producers of original equipment tires.

"The industry had announced increases during December, 1950, and Mr. DiSalle had requested that they hold the proposed increases in abeyance until discussion could be held by the companies with ESA officials.

"On the basis of these discussions Mr. DiSalle asked the representatives to re-examine their proposals in the light of ESA's voluntary pricing standards and to be guided by those standards.

"Edward F. Phelps, special assistant to Mr. DiSalle, presided at the final meeting today. Industry representatives included James J. Newman, B. F. Goodrich Co.; I. Eisbrouch, Dayton Rubber Co.; J. C. Ink, General Tire & Rubber Co.; E. J. Thomas, Goodyear Tire & Rubber Co.; Lee R. Jackson, Firestone Tire & Rubber Co., and H. E. Humphreys, Jr., U. S. Rubber Co."

ESA's voluntary pricing standards were announced December 19 and had these features relevant to the proposed tire price increases: Manufacturers should hold prices to the December 1, 1950, level, increasing them only in the event these prices did not permit a normal margin of profit, and to the extent necessary to assure that normal profit margin.

The tire manufacturers argued that by these standards the price increases were warranted. ESA's attitude is unclear. From its statements the assumption is that ESA's position is that it could not make a satisfactory evaluation either way on the basis of data submitted and in the time requested by the companies.

A still doubtful issue is the possible effect on tire prices of a mandatory price rollback to January 1 or 2 levels applicable to all business concerns, the course reported under active consideration by the Administration. Since the increases were not actually put into effect until mid-January, they might be rolled back under such an order. On the other hand, the companies, ESA agreed informally, might raise the issue of good faith, since the increases, announced before January 1 to take effect that day, were held up at ESA's request, and ESA finally failed to take a clear position on their propriety. This issue is the one which, an official

said, might have to be decided by ESA's attorneys.

ESA tire consultant, Peterson, headed the tire price section of the Office of Price Administration 3½ years. He is engaged in wholesale and retail tire and automobile business in Washington, D. C.

Heel Washer Problem

The two suppliers of steel heel washers for the manufacture of rubber heels described their difficulties in acquiring steel to the Senate Select Committee on Small Business at a public hearing held in Washington on January 20. Sen. John Sparkman, of Alabama, is chairman of this Senate committee.

James Campbell, general manager of D. R. Campbell Co., Boston, Mass., appeared in person to describe the "damaging fix" that his company and the other supplier, W. E. Bassett Co., are in.

"As a result of dislocations in steel supply stemming from NPA restrictions," he said, "our operations since October 31 have been a nightmare.

"Between the two of us," he continued, "we require about 546 tons per quarter of cold rolled steel to meet the requirements of the nation's 40 rubber heel manufacturers. Now, in a time of short supply, we are facing heavy military orders."

Campbell told a sympathetic Senate committee that experimental substitutes, such as plastic and fiber disks, have been tried without success.

Heel manufacturers have been operating on a "hand-to-mouth basis" since early October, shutting down from time to time when we were unable to obtain steel to cut washers for them." Shoe manufacturers and repair establishments have felt the effects. There are no inventories today, he added.

Heel manufacturers have been resorting to buying small lots of German steel at New York docks, paying 43¢ a pound for washers that should cost no more than 17¢, he said.

"Only a few manufacturers have been financially able to pay these premiums."

"Our appeals to the NPA for relief have been extremely disappointing. On the other hand we have been confronted with the statement that NPA has no authority to channel steel to fabricators like ourselves, as the end-use has not yet been declared essential. Their promises to make informal suggestions to steel suppliers have yet to help us in getting the necessary steel."

Campbell said his customers are "thoroughly baffled" when "on one hand NPA allots to them large quantities of rubber—a critical war material. On the other, it prohibits them from processing all their rubber by denying them a handful of steel in the form of washers."

W. E. Bassett Co. wrote a lengthy letter to Sen. William Benton, a Committee member. Bassett reported specific cases of shutdowns of heel plants and declared, "We have exhausted every possible avenue of relief and are still faced with a continuing shortage of steel for all of 1951. The best we have been able to do is secure promises for approximately 65% of the steel we require . . . it appears the matter will even become worse in 1951."

Bassett suggested that some arrangement be made to allocate steel for heel washer production similar to an NPA plan for allocating steel to warehouses.

Elsewhere, difficulties are reported in acquiring aluminum for eyelets for tennis shoes and other canvas footwear manufactured by the rubber industry.

Footwear Import Duties

The Administration has reintroduced its Customs Simplification Bill, which failed to get beyond the hearing stage in the last Congress. The bill, H. R. 1535, contains the same Section 14, banning American selling price for calculating import duties, that aroused the opposition of the rubber footwear industry and its union laborers last year. This section would require import duties to be calculated on the basis of the prevailing foreign wholesale price — the price in the country of origin.

The opposition argument is that the principal foreign competitors to U. S. rubber footwear are in nations employing so-called "slave labor" or paying exceedingly low wages, resulting in a foreign wholesale price with which U. S. Manufacturers cannot compete. The duties are determined as a percentage of the price.

The State Department has pressed for elimination of the American selling price to make the system of calculating duties uniform for all imported products, thereby simplifying customs procedures. The complexity of American customs procedures has been raised many times by foreign nations in discussions of trade barriers. The department had promised last year to take steps to assure that U. S. Manufacturers meeting competition for many years on American selling price articles will not be injured by a switch to foreign wholesale pricing. A handful of product categories is governed by the American selling price, including rubber footwear and some coal-tar chemicals.

The State Department, it is reported unofficially, plans to pair the Customs Simplification Bill with a three-year extension of the Reciprocal Trade Agreements program, whose current authorization expires June 12, 1951. The latter program is now so well accepted as a keystone of American foreign economic policy that a successful pairing of the two measures might ease the way for Congressional approval of the Customs Bill.

Other Industry News

Firestone Year-End Statement

Harvey S. Firestone, Jr., chairman of the Firestone company said in his year-end statement that we enter the new year faced with grave problems and pledged the support of his organization in aiding our country to accomplish the vital task of defense which confronts us following the declaration of a national emergency by the President.

Firestone's fiftieth year in business has been its best, and the rubber industry as a whole is completing a year of record-breaking operation, it was said. The industry's sales of tires for the year were about 104,000,000 units, 28% ahead of last year's figure and 8% ahead of 1947 sales, the previous record year.

Mr. Firestone pointed out that the automobile and truck industries had their greatest year, with total vehicle production of about 8,000,000. The tire industry's banner year had resulted from supplying these new vehicles with tires at the same time that replacement demand rose to very high levels.

"The industry's production outlook for next year depends upon available supplies of rubber far more than the usual factors of customer demand and buying power," Mr. Firestone explained. "It is

still too early to tell how much natural and synthetic rubber will be available, but we are hopeful that when all synthetic rubber plants are operating at capacity, supplies of synthetic rubber will be relatively plentiful. Increasing orders for military tires and other defense products should keep the rubber industry going at a very high rate in 1951."

CALENDAR

- Feb. 16. Detroit Rubber & Plastics Group, Inc. Detroit-Leland Hotel, Detroit, Mich.
Feb. 21. New York Section, SPE. Hotel Shelburne, New York, N. Y.
Feb. 23. Quebec Rubber & Plastics Group, Ladies' Night. Town of Mount Royal Community Hall, Montreal, P.Q., Canada.
Feb. 28 - Mar. 2. Division of Rubber Chemistry, A. C. S. Shoreham Hotel, Washington, D. C.
Mar. 1. SPI Reinforced Plastics Division Conference and Exhibit. Edgewater Beach Hotel, Chicago, Ill.
Mar. 1-31. Annual Appeal of the American Red Cross.
Mar. 5. ASTM. Spring Meeting and Committee Week. Cincinnati, O.
Mar. 6. The Los Angeles Rubber Group, Inc. Hotel Mayfair, Los Angeles, Calif.
Mar. 9. Chicago Rubber Group. Morrison Hotel, Chicago, Ill.
Mar. 13. Ontario Rubber Section, C.I.C. University of Toronto, Toronto, Ont., Canada.
Mar. 14. Newark Section, SPE. Military Park Hotel, Newark, N. J.
Chicago Section, SPE, and Midwest Chapter, SPI. Builder's Club, Chicago, Ill.
Mar. 15. Quebec Rubber & Plastics Group. Queen's Hotel, Montreal, P.Q., Canada.
Mar. 16. Boston Rubber Group.
Mar. 21. New York Section, SPE. Hotel Shelburne, New York, N. Y.
Mar. 27. Washington Rubber Group.
Mar. 30. New York Rubber Group. Henry Hudson Hotel, New York, N. Y.
Apr. 3. The Los Angeles Rubber Group, Inc. Hotel Mayfair, Los Angeles, Calif.
Apr. 6. Akron Rubber Group. Mayflower Hotel, Akron, O.
Apr. 11. Newark Section, SPE. Military Park Hotel, Newark, N. J.
Chicago Section, SPE, and Midwest Chapter, SPI. Builder's Club, Chicago, Ill.
Apr. 18. New York Section, SPE. Hotel Shelburne, New York, N. Y.
Apr. 19. Quebec Rubber & Plastics Group; SPE; and SPI. Combined Meeting. Queen's Hotel, Montreal, P.Q., Canada.
Apr. 20. Chicago Rubber Group. Morrison Hotel, Chicago, Ill.
Apr. 24. Washington Rubber Group.
Apr. 26. APS. High Polymer Physics. Washington, D. C.
Apr. 30. Fourth National Materials, May 4. Handling Exposition. International Amphitheatre, Chicago, Ill.
May 1. The Los Angeles Rubber Group, Inc. Hotel Mayfair, Los Angeles, Calif.
May 9. Newark Section, SPE. Military Park Hotel, Newark, N. J. Chicago Section, SPE, and Midwest Chapter, SPI. Builder's Club, Chicago, Ill.
May 16. New York Section, SPE. Hotel Shelburne, New York, N. Y.
May 22. Washington Rubber Group.

Mr. Firestone indicated that his company is making large-scale increases in its plant facilities in order better to keep up with the demand. These expansions include an \$8,500,000 factory expansion at Des Moines, Iowa, and a large expansion at Pottstown, Pa. In addition, Firestone facilities for manufacturing plastic and industrial products will be expanded during 1951.

"Our country's great need," said Mr. Firestone, "and that of our allies is to produce more goods . . . more war materials, more civilian goods, and more agricultural products. To this end we must have the best possible production performance, not only in America, but among our friends abroad, by industry, labor, and agriculture. With such production our international position will be strengthened at the same time that our domestic economies remain strong and healthy."

O'Neil Statement

William O'Neil, president of General Tire, in his year-end statement said the only factor that could cause a shortage of tires in the new year is hysteria on the part of the motoring public.

"A shortage can easily be created by a sudden hysteria wave," Mr. O'Neil warned, "and the results could be crippling to the industry. Normally the industry sells 55,000,000 tires in replacement sales to America's nearly 45,000,000 vehicle owners — and our industry can adequately handle this normal demand in 1951."

Mr. O'Neil insisted that the industry with its research and "know how" deserves commendation for America's good rubber position — and singled out General's new process¹ in connection with synthetic rubber as one of the reasons why the United States has become virtually self-sufficient in this strategic material.

When General offered its new process to the government some time ago, Mr. O'Neil pointed out that a tremendous saving in money and capital investment was possible because of it.

"Not only does it provide a better product, but the government could, by accepting our offer, increase production immediately by 22% in its present synthetic rubber plants," he explained.

"Normally we could retain exclusive rights to such an advancement for our own use — but with the world price of natural rubber at 70¢ a pound compared with GR-S at 24.5¢ a pound — we went to the government with our offer. A better rubber at little additional cost is always desired, but it is infinitely more desirable when the price of natural rubber goes to 70¢ a pound and higher," Mr. O'Neil declared.

If the industry operates normally in the new year, Mr. O'Neil saw little likelihood of rationing. A heavy and sudden military "call up" could change the entire production picture, however, he added.

With one of its biggest sales years in history behind it, General anticipates an equally big year in 1951.

"Our Aerojet Division in California, the world's largest producers of jet-assisted-takeoff units, is in a large expansion program to fill military requirements — and all our other divisions are prepared to assist in any way possible in the defense effort," the General president said.

¹ India RUBBER WORLD, Dec., 1950, p. 333.

Collyer Recommendations

John L. Collyer, Goodrich president, early in January sent a letter to Defense Mobilization Director Wilson expressing full confidence in his leadership and suggesting immediate positive action that he said must be taken to protect our national interest in terms of rubber.

"The step taken earlier to restrict rubber consumption at home, to reactivate synthetic rubber production facilities, and to centralize natural rubber buying and imports in the hands of the government are all important and necessary. Alone, however, they will not do the job," Collyer said.

Four steps that must be taken immediately in the interests of the defense program and the security of American citizens and friendly nations were recommended:

(1) The majority of the foreign countries presently consuming precious natural rubber to the limit of their product capacities are Atlantic Pact Nations receiving military and financial aid from the United States. Our common defense preparation objectives could be furthered, and the natural rubber supply position alleviated, if our government would prevail upon those nations, and on Western Germany and Japan, to restrict the use of natural rubber for civilian purposes just as the United States has done.

(2) Consumption restrictions in the United States and, when achieved, in the other nations mentioned above, will make sufficient natural rubber available to us and our allies only if exports from the rubber producing territories to Russia, her satellites, and, particularly, the non-consuming areas of Asia, are drastically reduced or cut off. Therefore, our government should strongly urge an immediate prohibition of such shipments.

(3) The favorable cost reduction objective of the government's move to take over natural rubber buying and importing can be achieved or lost, depending largely on the wisdom employed in the execution and administration of the program. The rubber industry, with its vast experience in the procurement of natural rubber, is anxious to make this experience and its manpower available to government for use in the prosecution of this buying program.

(4) Our nation's immediate rubber supply problem for current military and essential civilian production can be solved only through the most rapid possible reactivation of American rubber producing facilities. No time should be lost, and no effort spared, to insure full-scale synthetic rubber output.

Collyer said in his letter that control measures already in operation and reactivation of American synthetic rubber plants have had little effect on the serious price conditions that have existed in world crude natural rubber markets since April, 1950.

It was pointed out that world supplies of natural rubber in 1950 attained an all-time high, with output for the year now estimated at 1,850,000 long tons. The share coming to the United States, however, has been disappointingly low.

The Goodrich president said that before World War II and again in 1947 the United States received an average of 54% of the total world supplies of natural rubber, but that the proportion received in 1949 and 1950, for both current consumption and strategic stockpiling, was only 44%. He said this represented a loss to the United States of approximately 200,000 long tons of natural rubber.

Industry Operations

Manufacturers' shipments of passenger-car tires during November, 1950, were down 14.9% to 6,246,703 units from 7,340,146 in October, according to the RMA monthly report of January 19.

Production of passenger-car tires also decreased in November, falling 13.5% to 6,326,911 units from 7,313,860 units the month before. With production slightly higher than shipments, inventories at 3,596,186 units were 3.2% above the level of the previous month's end.

Shipments of truck and bus tires in November were down 8.2% to 1,256,996 units from 1,368,910 units in October; while production fell to 1,186,733 units from 1,345,287 in October, a decrease of 11.8%. Inventories totaled 858,048 tires, a reduction of 4.6% from the October 31 figure, when 898,902 tires were in stock.

Shipments of automotive inner tubes were down in November to 6,134,981 units, a decrease of 17.3% from October, when 7,417,991 tubes were shipped. Production was off 16.0% to 6,712,604 units, as compared with 7,987,691 the month before. Inventories of tubes were up 8.8% to 6,922,771 from the 6,400,392 on October 31.

In another regular monthly report the RMA, on January 29, estimated that new rubber consumption in the United States in December declined 2.9% to 94,687 long tons from 97,515 in November.

Consumption of natural rubber during December was down 13.2% to 43,955 long tons from the 50,663 tons used in November. Use of synthetic rubber totaled 50,732 long tons, an increase of 8.3% from the 46,852 tons used during the previous month. Synthetic rubber consumption by types in December was estimated at GR-S, 39,930 long tons; neoprene, 3,733 tons; Butyl, 6,041 tons; nitrile types, 1,028 tons.

Total natural and synthetic rubber consumption for 1950 were therefore estimated at 1,245,528 long tons, as compared with 988,903 tons in 1949. Of this total, 713,267 long tons were natural rubber, as against 574,522 tons in 1949, and 532,261 tons were synthetic rubbers in contrast to the 414,381 tons used in 1949.

Labor News

Goodyear and the United Rubber Workers, CIO, began negotiations on January 9 in Cincinnati, O., on a new company-wide contract on working conditions to replace the one expiring February 10. The negotiations were not to have included any discussion of wages, but the union decided as the meeting began to ask for a wage increase for its members because of the recent increases in the cost of living. Goodyear workers were granted a 12¢-an-hour wage increase on October 18, 1950.

Union representatives were recalled from the meeting on January 12, however, when a group of the members of the Akron local union decided that the negotiating committee was not to participate in any more discussions as long as Paul Bowers sits as an international representative. He, representing the international union, is held responsible for negotiating the recent wage settlement permitting the company to put pay raises since 1946 into the base rate—thereby reducing the standby earnings for some workers.

Bowers, in turn, said that the clause was put into the contract long before he was appointed the international representative in the Goodyear negotiations.

A special meeting of the Goodyear local January 13 asked rescinding the action recalling the negotiating committee.

EAST

U. S. Rubber Buys Esso Paracril Plant

United States Rubber Co., Rockefeller Center, New York 20, N. Y., has purchased the nitrile rubber plant of Esso Standard Oil Co. in Baton Rouge, La., as a major step in the expansion of its facilities for the manufacture of chemicals, plastics, and synthetic rubbers. The plant will be operated by the company's Naugatuck Chemical division, which will continue to market the rubber under the trade name, Paracril.

According to John P. Coe, company vice president and general manager of the Naugatuck division, the purchase was made for three reasons: (1) to provide a growing business in nitrile rubber which is in demand for many applications; (2) to increase the company's facilities to produce high styrene copolymer latex, in demand by the paint, paper, and textile industries; and (3) to provide added production facilities to meet sharply increasing demand by the plastics industry for the company's plastic-rubber blends.

The plant's present annual capacity is approximately 15,000,000 pounds of nitrile rubber and high styrene latex. U. S. Rubber plans to expand production facilities so that the plant will manufacture more than 30,000,000 pounds of nitrile rubber, high styrene latex, and rubber-plastic blends per year.

Garden Hose for Pineapples

What is said to be the world's largest "garden hose" has been developed by U. S. Rubber to water pineapples in Hawaii. Able to carry more than 700 gallons of water a minute, the hose is four inches in diameter, 800 feet long, and requires a hose reel eight feet in diameter. The hose is constructed with a rubber tube and cover and four plies of chemically treated cotton yarn and operates at a working pressure of 125 psi. It is being used in conjunction with a mobile spray rig to water pineapples on the Dole plantation in Hawaii.

For More Carbon Black

Recognizing that the carbon black industry currently lacks facilities for providing the additional furnace type blacks needed for our expanded synthetic rubber production program and for satisfying the increasing demands by various consuming industries, United Carbon Co., Inc., of Charleston, W. Va., will augment its furnace process facilities by erecting a plant in north Texas costing in excess of \$1½ million.

This plant, to be six miles east of Shamrock, Tex., will produce gas base furnace blacks of the SRF and HMF types. This plant will be in operation about May 1, 1951, and will have an eventual production rate of 25 million pounds a year.

Martin Rubber Co., Long Branch, N. J., has completed extensive alterations to its plant which will enable the firm to manufacture, economically, extruded shapes of all kinds, including tubing of various types.

G-E Appointments

General Electric Co., Schenectady, N. Y., has appointed Robert L. Gibson general manager of the chemical department with headquarters in Pittsfield, Mass. Formerly assistant general manager of the department, Mr. Gibson will be responsible in his new capacity to Harold F. Smiddy, G-E vice president in charge of the chemical department.

Mr. Gibson entered the business training course of General Electric immediately after graduation from college in 1925 and became engaged in market research work. In 1926 he was transferred to the Philadelphia office, in 1928 was granted a leave of absence to become director of public relations at Lafayette College, and in 1929 returned to G-E. He then served successively as manager of the newly organized market research division (1932); manager of industrial advertising and sales promotion (1933); an assistant to Robert S. Peare, G-E vice president in charge of public relations; advertising and sales promotion manager of the newly formed chemical department (1945); also manager of the personnel division (January, 1948); manager of the plastics division of the chemical department (June, 1948); and then assistant general manager of the department.

George S. Irby, also of the chemical department, has been made sales development supervisor of silicone rubber. Mr. Irby started with the company in March, 1945, shortly after his discharge from the U. S. Air Force. He first worked on the development of G-E silicone rubber and in March, 1949, was transferred to the application engineering section of the plastics division.

Bennett H. Tollefson, of the chemical department, has been named manager of sales planning and analysis for the plastics division. Mr. Tollefson first came to G-E as a student engineer. Completing the course in 1944, he then went to the methods and equipment laboratory where he remained six months before going to Kellex Corp., Oak Ridge, Tenn., to work on the Manhattan Project. Returning to G-E in 1946, he became a liaison engineer for the methods and equipment laboratory and in 1948 went to the Chicago sales office, to be responsible for the sale of molded plastics and fabricated silicone rubber.

Frederick G. Weigand, also of the chemical department, has been appointed sales manager of alkyl resin products and will have responsibility for the sale of Glyptal, the registered trade mark for G-E's alkyl resins, insulating varnishes and compounds, Formvar enamel, plasticizers, and Permalfil products. He will have his headquarters at Schenectady. Mr. Weigand, with the company since December, 1949, was previously an application engineer in the alkyl products engineering section.



Raymond C. Gaugler

New Cyanamid Head

American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N. Y., has elected Raymond C. Gaugler president to succeed the late Wm. B. Bell. The new president, who started with the company in 1917 in the accounting department, progressed through the positions of assistant treasurer and comptroller to treasurer, next became vice president in charge of finances and then executive vice president. Mr. Gaugler, who has been a director of Cyanamid since 1929, is also a director of several associated companies including Jefferson Chemical Co., Inc., Southern Alkali Corp., Southern Minerals Corp., Southern Pipeline Corp., North American Cyanamid, Ltd., Chemical Construction Corp., and Davis & Geck, Inc.

Thomas L. Perkins, of Perkins, Daniels & Perkins, was elected to the Cyanamid board to fill the vacancy caused by the death of Mr. Bell.

New Carbon Black Plants

A site for a new carbon black plant at Bayou Sale, La., has been acquired by Godfrey L. Cabot, Inc., 77 Franklin St., Boston 10, Mass. Cabot Carbon Co., of the firm's subsidiaries, plans to erect a thermal carbon black plant of 30,000,000 pounds' annual capacity and an adjoining oil furnace carbon black plant of 50,000,000 pounds' annual capacity at the new location. Negotiations for a natural gas supply, for use as a raw material in the thermal black process, have been completed.

The oil furnace units will operate on liquid hydrocarbons and residue oils and tars as raw materials. The thermal blacks will be produced for the rubber industry, with a small percentage of production being further processed for metallurgical use. The oil furnace black unit will represent an important addition to the supply of HAF and FEF blacks needed by the expanded government synthetic rubber program. The new project will represent an investment in excess of \$4,000,000 when completed.

Timken Advances Three

The Timken Roller Bearing Co., Canton, O., has appointed Dwight A. Bessmer, director of purchases, to the position of assistant to the president. He joined Timken's industrial division in June, 1933, then served as a service engineer from 1934 to 1935, when he was transferred to the automotive division as a sales engineer in the Detroit office. He was made director of purchases in 1940.

Paul E. Young succeeds Mr. Bessmer as director of purchases, and R. J. Archibald has been named assistant general purchasing agent.

Young, a Timken 16-year man, worked in the Canton bearing factory for five years as a file tester, inspector, and special grinder and in the fuel injection department before being transferred to the purchasing department as an expeditor in 1940.

Archibald joined the company's Boston office 15 years ago as manager of the stockroom and later became a sales representative for the service-sales division, covering New England.

New Puncture-Proof Tube

A new lightweight puncture-proof Butyl tube has been announced by The Firestone Tire & Rubber Co., Akron, O. Said to be the first of its kind to be made entirely of Butyl, the new tube seals itself instantly when punctured, will hold air many times longer than do natural rubber tubes, and is further claimed to outlast several sets of tires. The price of the new tube is said to be 25% lower than that of similar products now on the market. The tube is made in three layers with two puncture-sealing elements under the tread. The inner layer is a special soft Butyl which will flow around a nail or similar object to prevent loss of air. An intermediate layer of especially compounded Butyl resists tearing or enlargement of puncture holes, and the tough, heat resisting outer layer of butyl provides superior air retention. Tires equipped with the new tube are said to be easier to balance, easier riding because of its greater flexibility, and cooler running and safer at any speed.

Charleston Rubber Co., manufacturer of safety equipment, Stark Industrial Park, Charleston 58, S. C., recently expanded its manufacturing facilities for the production of electricians' and synthetic industrial rubber gloves and allied safety equipment. This expansion program included erection of two masonry buildings together with complete remodeling of a warehouse to make it a production unit. The firm, besides, recently purchased another building for use as a warehouse and possible future productive unit. Thus Charleston Rubber has approximately doubled its available floor space and tripled its productive capacity for all types of gloves.

Secretary-Treasurer P. A. Belknap reports that current sales are running about 2½ times those of a year ago, and the company is constantly appointing new distributors in the United States and Canada to increase area of distribution.

American Polymer Corp., Peabody, Mass., has appointed Harold Naidus director of research and Max Potash chief engineer. Mr. Naidus will supervise the expanding chemical research program of the company; while Mr. Potash will be in charge of process development and design.

Stauffer Chemical Co., 420 Lexington Ave., New York 17, N. Y., plans to install additional equipment at its Niagara Falls, N. Y., plant further to expand chlorine production. A 50% expansion was announced a year ago and will be completed within 60 days. The new expansion just announced will bring total daily capacity to well over 100 tons and is expected to be complete by the first of next year. Chlorine production facilities at Stauffer's plant in Henderson, Nev., were also enlarged within recent months.

Buys Plant Site

Dewey & Almy Chemical Co., Cambridge, Mass., has purchased in Cedar Rapids, Iowa, a site for the erection of a factory for manufacturing Cry-O-Rap plastic bags used for packaging frozen meat, fish and poultry, and smoked, cured, and processed meats.

While details of plant capacity, number of employees, and other manufacturing details are still to be worked out, President Bradley Dewey said that present plans call for approximately 200 employees and a production of 100,000,000 bags a year. He said that construction of the plant would start immediately. Mr. Dewey was accompanied on his visit to Cedar Rapids by Hugh S. Ferguson, executive vice president of the company.

Production of Cry-O-Rap bags, also made at a plant in Lockport, N. Y., will be approximately doubled when the Cedar Rapids plant is in operation, said Mr. Dewey.

Witco Broadening Services

Witco Chemical Co., 295 Madison Ave., New York 17, N. Y., is broadening and streamlining its technical service department to provide industry with more information on critical materials and substitutes to help offset shortages and to provide essential industry with the quickest possible service during the national emergency. Made in close cooperation with Continental Carbon Co., producer of the carbon blacks sold by Witco, the move involves the shifting of responsibilities for research and technical service personnel and the organization of specialist groups to give more rapid solutions to customers' problems.

E. F. Wagner is director of technical service, and research and development will be centralized in the company's Chicago laboratories under the direction of Wilbur B. Pings. Witco specialists available to industry on a countrywide basis to assist in solving technical problems follow: R. D. Wendt, stearates; Howard Packer, driers; Konrad Parker, plastics and stabilizers; H. R. Spielman, waxes and rubber chemicals; George Freese, asphalt development; Robert Kufrin, asphalt specialties and mastics; and W. J. Tanner, carbon black in ink.

New York Industrial Show

The Greater New York Industrial Show, a new type of exhibition designed to be of interest to hundreds of different categories of manufacturers in this area, will be held May 7-11 at the 71st Regiment Armory, New York, N. Y. The Show is being sponsored by the Technical Societies Council of New York, Inc., an affiliation of the New York sections of 17 technical societies, with a membership of over 15,000.

In contrast with the usual vertical or specialized exposition, this show will present machinery, tools, materials, processes, methods, and new ideas in the manufacture and fabrication of a great variety of finished products. Government procurement agencies are to be offered space without charge for presenting information to those interested in obtaining government orders. Free technical advisory service will be an added feature, and forums, lectures, and clinics will be conducted by experts in their respective fields.



Douglas Mueller

Changes at Seiberling

Douglas Mueller, director of public relations for Seiberling Rubber Co., Akron, O., has been named also assistant to President J. P. Seiberling. Mr. Mueller will continue to supervise public relations activities and will assist Mr. Seiberling as "expediter, liaison, and substitute on special assignments." A former reporter for Cleveland newspapers, Mueller joined Seiberling in 1941 in the advertising department and was named public relations director in 1946, after returning from military service.

Lester G. McCurdy has been named employment manager of Seiberling Rubber Co., Akron, O. He worked a short time at Goodyear Tire & Rubber Co. after discharge from the Navy, then joined the time study staff at the Seiberling company in 1946.

Acrylic Monomer Price Cut

Rohm & Haas Co., Washington Sq., Philadelphia 5, Pa., has announced a price reduction of 8¢ per pound on its methyl methacrylate monomer in carload quantities. The new price is 36½¢ a pound, and the price in tank car quantities is 35¢ a pound. This reduction of approximately 18% on a price which has been stable for 10 years is particularly noteworthy in these times of rising prices and was made possible by improved manufacturing processes and increased demand for the product.

United Engineering & Foundry Co., Pittsburgh, Pa., has advanced Neal J. Crain to the position of director of purchases, and John C. Utz to purchasing agent. These appointments followed the death of G. Walter Sanborn on December 15. Mr. Crain, with the company since 1914, has been purchasing for 37 years, originally as an invoice clerk, later becoming a buyer, and from 1938 until his latest promotion as purchasing agent. Mr. Utz, since beginning his association with the company in 1923, originally employed as clerk and accountant in the treasury department, was a buyer in the purchasing department from 1930 until his new appointment.

Ups Carbon Black Output

J. M. Huber Corp., 342 Madison Ave., New York 17, N. Y., is doubling the size and capacity of the new furnace carbon black plant under construction near Baytown, Tex. Originally planned last July to produce 36,000,000 pounds annually of HAF-type carbon black, the revised construction estimates call for an annual capacity of 72,000,000 pounds.

The first unit will be ready for production on May 15, and the second on November 1. The plant site has been named Aromex, Tex., after Huber's trade name for this new furnace-type carbon black, the raw material for which is oil.

The Huber corporation, incidentally, is moving its New York offices to 100 Park Ave., New York 17.

Goodrich Notes

The B. F. Goodrich Co., Akron, O., on December 31, 1950, quietly observed its eightieth birthday. It was on December 31, 1970, that the young surgeon, Dr. Benjamin Franklin Goodrich, founded, with less than \$20,000, the rubber industry in Akron.

Carl J. Tsaloff has been named manager of Goodrich's Cadillac, Mich., plant to succeed Felix G. Tanner, who retired because of his health. With the company the last 18 years, Tsaloff has been at Cadillac for the past 18 months and for the last six months was acting plant manager. Beginning as a factory worker, while attending the University of Akron, Tsaloff became a floor and shift foreman in the Akron plants before he received his college degree in 1939. During World War II he was a production and technical staff man in the Lone Star Ordnance Plant at Texarkana, Tex., which Goodrich operated for the government. At the end of the war Tsaloff returned to Akron, became a conference leader in the company's education program, and later night shift superintendent at one of the Akron plants.

Reclaimers Elect Officers

Robert E. Casey, Naugatuck Chemical Division of United States Rubber Co., was reelected president of the Rubber Reclaimers Association at the annual meeting in January, held at the Hotel Commodore, New York, N. Y. Daniel S. Morse, Bloomingdale Rubber Co., and C. T. Jansen, *Rubber Age*, were reelected vice president and secretary-treasurer, respectively. The 1950 board of directors, also reelected for 1951, includes T. N. Mace, Pequannock Rubber Co.; J. H. Nesbit, U. S. Rubber Reclaiming Co.; C. R. Shaffer, Xylos Rubber Co.; J. E. Thomas, The B. F. Goodrich Co.; and G. K. Trimble, Midwest Rubber Reclaiming Co. Mr. Nesbit was reappointed chairman of the Association's executive committee.

Diamond Alkali Co., 300 Union Commerce Bldg., Cleveland 14, O., at a special stockholders' meeting January 5 approved a stock option plan for officers and key employees, ratified an agreement providing for a pension plan for hourly workers at the Painesville, O., plant and authorized amending the company's pension plan for salaried employees.

Goodyear Appointments

The Goodyear Tire & Rubber Co., Akron, O., on January 10 formally opened its new district office and warehouse at Lincoln and Moseley Sts., Wichita, Kan., which replaced the former one, an early casualty of World War II. More than 300 tire dealers from the 75 Kansas counties to be served by the new distribution center attended the affair.

Heading the district office, which in its new structure provides more than 22,400 square feet of floor space, is R. N. Moore, district manager. L. J. Harrer is district operating manager; E. O. Cooper, district credit manager; and D. D. Hutchens, district service representative.

Charles W. Howard has joined the rim sales staff of The Goodyear Tire & Rubber Co. as a field contact man.

Product Developments

Progressive thinking by the Chicago, Wilmington & Franklin Coal Corp. and the engineering knowledge of Goodyear technicians have combined to produce what is said to be the world's highest lift conveyor belt. Recently installed in a new mine near Waltonville, Ill., the 42-inch wide belt is constructed of rubber, fabric, and steel and is capable of carrying 1,200 tons of coal an hour up a 3,290-foot slope to a height of 868 feet. The belt moves at a speed of 625 feet a minute. To produce the belt Goodyear used 240 steel cables as a core, 23,648 pounds of fabric, and 75,292 pounds of high-quality rubber in the cover.

A new type of air filter for forced draft hot air furnaces and air conditioning systems has been developed by the Goodyear Research laboratories. According to R. P. Dinsmore, vice president in charge of research and development, the new product is a self-charging electrostatic air filter which takes advantage of the dielectric properties of polyethylene and other plastic materials. The material used in the filter is a thin film shredded into a porous mass. This material, when exposed to a current of air, picks up an electrostatic charge which serves to attract and retain the finest of dust, soot, or smoke particles suspended in the air, Dr. Dinsmore explained. Even the microscopic solids in cigarette smoke which pass through conventional filters are caught by the new filter, and preliminary tests indicate that the new product may prove satisfactory in removing pollen from the air in homes of allergy victims. Unlike conventional filters, the Goodyear air filter can be cleaned and fully regenerated by immersing into water containing a detergent and then immediately replacing in use without any deteriorating effect.

Charles Goodyear Honored

Charles Goodyear, discoverer of vulcanization, was paid tribute by Goodyear and other major rubber companies and by civic and honorary groups in Akron, on December 29 at memorial services marking the one hundred and fiftieth anniversary of his birth. The ceremonies were held at Charles Goodyear Park where wreaths were placed at the base of the inventor's statue by representatives of the rubber companies and other groups. Among those placing wreaths were P. W. Litchfield, Goodyear board chairman; J. L. Cochran, vice president of Seiberling Rubber Co.; Joseph Thomas, secretary of Firestone Tire & Rubber Co.; L. L. Smith, treasurer of The B. F. Goodrich Co.; and C. E. Slusser, mayor of Akron.

Johnson & Johnson, New Brunswick, N. J., has equipped a fleet of fork trucks at its Metuchen, N. J., shipping center with two-way radios to give more efficient materials handling. The fleet consists of seven Skylift electric fork trucks of 2,000-pound capacity, made by Automatic Transportation Co., and two-way Motorola short-wave radio sets were installed on the trucks near the driver's seat. A master short-wave station is located in central dispatching headquarters. By means of the radio system, the dispatcher knows where all trucks and their merchandise are and is able to shift trucks and goods with exceptional speed.

New York Quartermaster Procurement Agency, 111 E. 16th St., New York 3, N. Y., recently awarded contracts for the following: shoe pacs, 102,000 pairs, United States Rubber Co., Naugatuck, Conn.; 120,000 pairs, Rubber Corp. of California, Garden Grove, Calif.; 25,682 pairs, Bristol Mfg. Co., Bristol, R. I.; 55,000 pairs, Mishawaka Rubber & Woolen Mfg. Co., Mishawaka, Ind.; 167,000 pairs, Hood Rubber Co., Watertown, Mass.; 11,000 pairs, Converse Rubber Corp., Malden, Mass.; 63,650 pairs, Goodyear Rubber Co., Middletown, Conn.; rubber firemen boots, 7,045 pairs, Hood Rubber.

Erecting Research Center

Construction of a new research center and expansion of the research and development activities of Wyandotte Chemicals Corp., Wyandotte, Mich., were announced January 4 by Robert B. Semple, company president.

The Wyandotte research center will be housed in a functionally engineered two-story structure to be constructed immediately near the company's administration building in Wyandotte and will be approximately a city block long and a half block wide. It will operate under the general direction of Thomas H. Vaughn, vice president in charge of research and development. Occupancy is scheduled for mid-1952.

The center will permit a consolidation of Wyandotte's many research and development activities and also will enable the company materially to expand its scientific and technical staff to handle not only long-range research within the organic and inorganic chemical fields, but special research projects assumed by the company in behalf of the national defense program.

Principal scientific groups which will work in the new center will be concerned with research investigations in the fields of atomic tracers, physics, electronics, bacteriology, organic and inorganic chemistry, and detergency in the industrial, textile, and food technology fields.

Personnel Changes

Paul Weller has been appointed district manager, Cincinnati office, of the Michigan Alkali Division, Wyandotte Chemicals. Mr. Weller came to the company in 1945 as a market research analyst, having previously been associated with Goodyear Tire & Rubber Co. as a development engineer. Mr. Weller assumed directorship of the market research department at Wyandotte in 1947.

Ed Heiser assumes the position of field supervisor alkali sales, at the Cincinnati office.

Robert Fosburg, field supervisor of the calcium chloride department, has been transferred as senior sales representative to the New York district office.

The following appointments were also effective January 1: Chas. S. Sanborn, appointed manager, market research department; C. J. Farcašin, field supervisor, calcium chloride department, Cincinnati office; J. M. Norcott, transferred to the J. B. Ford Division, manager, Pacific industrial chemicals department.

Walter L. Rippetteau has been made manager, organic chemical sales department, Michigan Alkali Division. Mr. Rippetteau joined Phillips Petroleum Co. in 1939 as research engineer, between 1941 and 1946 served in the Chemical Corps of the U. S. Army, then returned to Phillips as technical field representative in the chemical products division. In 1947, Mr. Rippetteau came to Wyandotte as a technical field representative, research and development division, and became manager in the market development department in 1949.

WEST

New Johnson Distributer

The Johnson Corp., Three Rivers, Mich., has announced a change in representation on the West Coast. Guy L. Warden & Sons, formerly district representative for Johnson in lower California, will now cover the entire state as well as the counties of Curry, Josephine and Jackson in Oregon. In addition to the offices at 209 W. 12th St., Los Angeles 15, Calif., Warden & Sons has opened offices at 5200 E. 12th St., Oakland 1, Calif.

Both addresses will carry a complete stock of Johnson products such as rotary pressure joints, compressed air separators and aftercoolers, boiler water controls and solenoid valves, as well as service parts for Johnson boiler feed systems and the Johnson Electrap.

Stillman Rubber Co. has moved from S. Budlong Ave., Los Angeles, to 5805-09 Marilyn, Culver City, Calif.

The Barrett Division, Allied Chemical & Dye Corp., New York, N. Y., is undertaking a \$4,500,000 expansion project in Chicago, Ill., to increase substantially present capacity for the production of phthalic anhydride, now being manufactured at the company's Philadelphia, Pa., and Ironton, O., plants. Also included in this project are added refining facilities and an entirely new power plant. The Chicago location for the new facilities, which will be in volume production by the end of 1951, will permit the company to serve the ever-increasing demand for this chemical raw material in the important industrial Chicago-Detroit area.

Caram Mfg. Co. is now in operation at its new plant at 520 E. Evergreen, Monrovia, Calif. The new plant was built on a 1½-acre site and includes a new and complete laboratory. The company, established in 1928, manufactures rubber cement, adhesives, and coatings, both latex and solvent types.

Monsanto Appointments

Monsanto Chemical Co., St. Louis, Mo., has appointed Monte C. Throdahl assistant director of research, and Kenneth L. Godfrey research group leader for the Rubber Service department at Nitro, W. Va.

Mr. Throdahl joined the company at Nitro in 1941 as a control chemist in the research department, became a research group leader in 1946, research supervisor for rubber chemicals in May, 1950, and during the past two years has served in a liaison capacity between Nitro research and the Rubber Service sales office at Akron, O. In his new assignment he will continue primary responsibility for rubber chemicals, but will assume additional responsibility for other phases of the Nitro research program.

Mr. Godfrey started with Monsanto in 1936 as a control chemist at Nitro and in 1940 was transferred to the Nitro research department as a research chemist in the field of organic synthesis, with primary emphasis on oil additives.

R. U. Haslanger has been appointed manager of the newly created sales department of Monsanto's Texas division at Texas City, and will be responsible for the sales development of the division. Mr. Haslanger has been in charge of the division's sales development activities since April, 1950. He has been with Monsanto since 1939, served five years in the plastics division research department at Springfield, Mass., and subsequently as an engineer in the general development department in St. Louis; in 1947 became assistant to the president at the general offices in St. Louis; in 1948 was transferred to the western division as assistant to the general manager, and became assistant general manager in February, 1949.

Clement R. Letarte, correspondent at Monsanto's plastic division plant at Springfield, Mass., has been appointed plastics sales representative of the company's Los Angeles, Calif., office. Mr. Letarte has been with Monsanto since 1934 except for three years' military service.

Thomas A. DeMarco has joined the sales development staff of Monsanto's plastics division. Previously he had been employed by Owens Corning Fiberglas Corp., Johns-Manville Sales Corp., Gar Wood Industries, and Chapman Valve Mfg. Co.

NEWS ABOUT PEOPLE



© Fabian Bachrach
John M. Bierer

John M. Bierer has been named executive vice president and general manager of Boston Woven Hose & Rubber Co., Cambridge, Mass. Mr. Bierer, who started with the company in 1912, has served successively as chief chemist, technical superintendent, assistant factory manager, factory manager and vice president.



Wilbur B. Pings

Wilbur B. Pings has been appointed by Witco Chemical Co. as director of research, with headquarters at 6200 W. 51st St., Chicago, Ill. Dr. Pings has had long experience in planning and direction research, having been employed as chemist at the E. I. du Pont de Nemours & Co., Inc., experimental station for nine years and more lately as research executive with Arthur D. Little, Inc., and Godfrey L. Cabot, Inc.

John M. Cook has joined the Cryovac division of Dewey & Almy Chemical Co., Cambridge, Mass., to do development and sales service work, with particular emphasis on frozen foods.

N. J. Hooper, vice-president and director of Sharples Chemicals, Inc., 123 S. Broad St., Philadelphia 9, Pa., in addition to his other duties, has been placed in charge of the company's mobilization planning. **George R. Lawson** has been appointed general sales manager.

R. R. Coleman is now chief chemist at Sierra Rubber Products & Engineering Co., Inglewood, Calif.

Howard Lee Young has been named assistant sales manager of American Zinc Lead & Smelting Co. and American Zinc Sales Co., with offices at 1600 Paul Brown Bldg., St. Louis, Mo.

Gladding B. Coit has been elected executive vice president of General Latex & Chemical Corp., 666 Main St., Cambridge 39, Mass. Mr. Coit, who joined the firm in November, 1949, to serve in an executive capacity, has long been associated with the financial and banking professions and also was a member of the Reconstruction Finance Corp., the War Department Price Adjustment Board, and the War Contracts Price Adjustment Board.

E. N. Cunningham, formerly branch manager for Enjay Co., Inc., in Elizabeth, N. J., has joined the staff of Precision Rubber Products Co., 3110 Oakridge Dr., Dayton, O. He took up his new duties on January 15.

H. E. Shawver has been appointed manager of construction industry sales for Hewitt-Robins, Inc., New York, N. Y. He will maintain his office for sales of Rubber and Conveyors divisions products of the organization in Dallas, Tex., and will be responsible for Hewitt-Robins sales to the construction industry in all parts of the country. Mr. Shawver has 27 years' experience in the construction field.

Paul J. Larsen, former Director of the office of Civil Defense of the National Security Resources Board, has been appointed assistant to Roy C. Ingersoll, president of Borg-Warner Corp., 310 S. Michigan Ave., Chicago 4, Ill.

Ralph T. Nazzaro, associate professor of forest chemistry, College of Forestry, Syracuse University, has become director of research for Texon, Inc., South Hadley Falls, Mass. His previous connections had been Premoid Products, Inc., Mellon Institute of Industrial Research, and American Resinous Chemicals Corp., and while with the College of Forestry he had been concerned with the instructional work in the field of polymer research and also of plastics.

Burt Wetherbee, of Buffalo, N. Y., who is the agent in the State of New York for Cooke Color & Chemical Co., Glen Rock, N. J., is extending his coverage of the company's products to include the State of Michigan.

Bemis Bro. Bag Co., St. Louis 2, Mo., has arranged for two textile engineers from The Netherlands, who are visiting this country for eight months to study American textile production methods, to be its guests at two of its cotton mills in Bemiston, Ala., and Bemis, Tenn. In cooperation with ECA, the Netherlands Government, and Consultants, Inc., Bemis arranged for H. W. Tijben and J. O. Sielcken to spend full time in analyzing American textile manufacturing techniques under the guidance of Bemis advisers.

Arthur T. Dalton, secretary of Chicago Wheel & Mfg. Co., Chicago, Ill., has been appointed to the Advisory Committee, Abrasive Industry of the National Production Authority, Washington, D. C.

Al Pickard has been promoted by Braun Corp., Los Angeles, Calif., to the position of sales manager of its apparatus division.

OBITUARY FINANCIAL

Felix G. Tanner

FELIX G. TANNER, manager of the Cadillac, Mich., plant of The B. F. Goodrich Co. since 1944 until his retirement because of health several weeks ago, died January 18 in Cadillac, where funeral services also were held on January 20.

Born May 1, 1897, in Brownstown, Ind., Tanner went to Indiana State Normal and came to Akron in 1919. He started with Goodrich as a factory employee in the industrial products division in 1932, became a shift foreman six years later, and a general foreman in the industrial products division in 1941.

The deceased was a member of the Masons, the Manufacturers Association, Foremen's Club, and Kiwanis Club in Cadillac.

He leaves his wife, a son, two brothers, his father, and two sisters.

CANADA

Tire Prices Up

Canadians are now paying 7.5% more for their passenger-car tires as a direct result of the United States' stockpiling a large percentage of its crude rubber imports. Truck tires in Canada have risen 7.5-10%; while tires for construction machines are up 15%. Other rubber articles, including footwear, hot water bottles, garden hose, and electrical insulation, are expected to rise in price shortly.

It is reported that Canadian tire companies will probably begin concentrating on synthetic rubber for tire production in an effort to bring prices down. Production of synthetic rubber at the government-owned Polymer Corp. plant at Sarnia, Ont., has been stepped up, but is still far short of Canadian needs. Stocks of imported crude rubber in Canada at the end of last September totaled 9,101,120 pounds, some 3,000,000 pounds below the total for September, 1949, and one of the lowest figures since the end of World War II.

Dividends Declared

COMPANY	STOCK	RATE	PAYABLE	STOCK OF RECORD
American Hard Rubber Co.	Com.	\$1.00 extra	Dec. 30	Dec. 18
Carborundum Co.	Pfd.	1.75 q.	Dec. 30	Dec. 18
Corduroy Rubber Co.	Com.	1.00 extra	Dec. 20	Dec. 8
	Com.	0.25	Dec. 20	Dec. 8
	Com.	2.50	Dec. 5	Nov. 30
	\$3 Pr. Pfd.	3.00	Dec. 5	Nov. 30
	Ptc. Pfd.	2.50	Dec. 5	Nov. 30
Denman Tire & Rubber Co.	Com.	0.10 extra	Dec. 27	Dec. 15
	Com.	0.05 q.	Dec. 27	Dec. 15
Dunlop Tire & Rubber Goods, Co., Ltd.	Pfd.	0.12½ q.	Dec. 27	Dec. 15
Faultless Rubber Co.	5% Cum. Red.	2½%	Dec. 30	Dec. 14
	1st Pfd.	0.25 extra	Dec. 26	Dec. 15
Garlock Packing Co.	Com.	0.50 q.	Jan. 2	Dec. 15
General Tire & Rubber Co.	Com.	0.50	Dec. 27	Dec. 15
Goodyear Tire & Rubber Co. of Canada, Ltd.	4½% Pfd.	1.06½ d.	Dec. 29	Dec. 19
Jenkins Bros.	3½% Pfd.	0.93¾ q.	Dec. 29	Dec. 19
Mansfield Tire & Rubber Co.	3½% Pfd.	0.81¼ q.	Dec. 29	Dec. 19
	Com.	2.00 yr. end	Dec. 30	Dec. 11
	Edrs.	2.00 yr. end	Dec. 28	Dec. 21
	Edrs. Nv.	0.50 yr. end	Dec. 28	Dec. 21
	Nv.	1.00	Dec. 28	Dec. 21
	Com.	0.25	Dec. 28	Dec. 21
	Com.	0.25 q.	Dec. 20	Dec. 9
	Com.	0.30	Dec. 20	Dec. 9

The Armstrong Rubber Co., West Haven, Conn., and wholly owned subsidiary, Armstrong Rubber Mfg. Co., Des Moines, Iowa. Year ended September 30, 1950: net earnings, \$2,423,542, equal to \$6.34 each on the combined Class A and B common shares, contrasted with \$656,287, or \$1.51 a combined share, in the preceding fiscal year; net sales, \$42,169,263, against \$31,501,237; provision for federal income taxes, \$1,623,752, against \$405,083; current assets, \$15,785,335, current liabilities, \$6,258,035, compared with \$11,874,258 and \$3,905,056, respectively, on September 30, 1949.

Carborundum Co., Niagara Falls, N. Y. Nine months ended September 30, 1950: net income, \$4,842,888, equal to \$9.51 a common share; net sales, \$39,160,065.

Dayton Rubber Co., Dayton, O., and subsidiaries. Year ended October 31, 1950: net profit, \$2,241,013 (a new high), equal to \$4.74 each on 453,341 common shares, contrasted with net loss of \$83,106 in the preceding fiscal year; net sales, \$37,199,454 (another record), against \$23,528,342.

The B. F. Goodrich Co., Akron, O., and subsidiaries. Nine months ended September 30: net income, \$21,967,990, equal to \$15.61 a common share, contrasted with \$12,451,690, or \$8.34 a share, in the corresponding period of 1949; net sales, \$389,099,197, against \$283,393,796.

Lea Fabrics, Inc., Newark, N. J. Six months ended November 30, 1950: Net profit, \$409,000, equal to \$1.95 a share, against \$202,500, or 96¢ a share, in the 1949 period.

A. G. Spalding & Bros., Inc., New York, N. Y. Year ended October 31, 1950: consolidated net earnings, \$1,623,384, equal to \$3.12 each on 520,575 common shares, contrasted with \$944,827, or \$1.81 a share, in the preceding fiscal year; net sales, \$22,830,886, against \$20,967,362; income taxes, \$1,125,628, against \$593,766.

Firestone Tire & Rubber Co., Akron, O. Year ended October 31, 1950: net profit, \$33,267,561, equal to \$16.75 each on 1,951,934 common shares, contrasted with \$17,823,621, or \$8.81 each on 1,951,334 shares, in the preceding fiscal year; net sales, \$690,571,555, against \$579,606,107; income taxes, \$39,200,000, against \$12,350,000; deductions for unremitted foreign earnings, \$6,480,247, against \$5,169,652; current assets, \$247,638,461, current liabilities \$9,544,336, compared with \$211,401,099 and \$47,020,133, respectively, on October 31, 1949.

Midwest Rubber Reclaiming Co., East St. Louis, Ill. Year ended October 31, 1950: net income, \$902,446, equal to \$2.94 a common share, against \$392,506, or \$1.11 a share, in the previous 12 months; net sales, \$6,631,692, against \$4,240,241.

Lee Rubber & Tire Corp., Conshohocken, Pa., and subsidiary. Year ended October 31, 1950: net income, \$3,381,913, equal to \$13.33 each on 253,584 capital shares, contrasted with \$1,211,499, or \$4.78 a share, in the preceding fiscal year; net sales, \$39,267,254, against \$31,947,034; income taxes, \$2,481,115, against \$815,752; current assets, \$20,569,860, current liabilities, \$3,679,286 compared with \$16,808,044 and \$1,978,052, respectively, on October 31, 1949.

Rome Cable Corp., Rome, N. Y. Nine months to December 31, 1950: net profit, \$991,151, equal to \$2.31 a share.

Carbon Black Statistics — Third Quarter, 1950

Following are statistics for the production, shipments, producers' stocks, and exports of carbon black for the third quarter, 1950. Furnace blacks are classified as follows: SRF, semi-reinforcing furnace black; HMF, high modulus furnace black; FEF, fast extruding furnace black; and HAF, high abrasion furnace black. Statistics on thermal black are included with SRF black to avoid disclosure of individual company operations.

	(Thousands of Pounds)	July	Aug.	Sept.
Production:				
Furnace types:				
SRF	27,368	27,930	28,355	
HMF	6,822	8,699	8,904	
FEF	12,072	14,714	14,365	
HAF	20,345	20,673	20,380	
Total	66,607	72,016	72,004	
Contact types...	51,894	52,601	52,693	
TOTALS....	118,501	124,617	124,697	
Shipments:				
Furnace types:				
SRF	27,523	30,902	32,072	
HMF	8,753	10,004	12,837	
FEF	15,922	14,706	14,220	
HAF	22,098	22,803	20,250	
Total	74,296	78,415	79,379	
Contact types...	52,643	63,896	69,323	
TOTALS....	126,939	142,311	148,702	
Producers' Stocks, End of Period:				
Furnace types:				
SRF	14,294	11,322	7,605	
HMF	8,000	8,156	4,223	
FEF	2,486	2,494	2,639	
HAF	9,811	6,220	6,350	
Total	34,591	28,192	20,817	
Contact types...	83,530	72,235	55,605	
TOTALS....	118,121	100,427	76,422	
Exports:				
Furnace types...				
SRF	9,712	8,832	15,170	
Contact types...	16,329	18,211	28,998	
TOTALS....	26,041	27,043	44,168	

SOURCE: Bureau of Mines, United States Department of the Interior, Washington, D. C.

Foreign Trade Opportunities

The firms and individuals listed below recently expressed their interests in buying in the United States or in United States representations. Additional information concerning each import or export opportunity, including a World Trade Directory Report, is available to qualified United States firms and may be obtained upon inquiry from the Commercial Intelligence Unit of the United States Department of Commerce, Washington, D. C., or through its field offices, for \$1 each. Interested United States companies should correspond directly with the concerns listed concerning any projected business arrangements.

Import Opportunities

Hans Klepper, representing Klepper-Werke, Rosenheim, Germany; Klepper boots and raincoats.

Veritas Gummiwerke, A.G., Schutte-Lanz-Strasse 61-65, Berlin-Lichterfelde-Ost, Germany; rubber buffers for resonance oscillating filters for coal-sorting machines, profile strings for automobiles, forms-articles for automobiles, rubber-metal binding, rubber toys.

Mitsuboshi Cutlery Co., Ltd., P. O. Box 882, Tokyo Central, Tokyo, Japan; elastic braids.

Brit-Over, Ltd., 27 Chancery Lane, London, W.C.2, England; pigments for the rubber industry.

Kaiserslauterer Verbandstoff-Fabrik Emil Bender, G.m.b.H., 4 Gersweilerweg, Kaiserslautern, Germany; bandages and adhesives.

Shichijo Trading Co., Yonei Bldg., 2-chome, Ginza, Chuo-ku, Tokyo, Japan; rubber toys.

Heiwa Shoji Kaisha, Ltd., No. 7, 1-chome, Sakaguchi-Dori, Kohi, Japan; rubber goods.

Ets. L. De Bruyn & Fils, 435 Chaussée de Gand, Alost, Belgium; baby nipples, latex gloves, finger protectors.

U Hla Maung, 47 Mogul St., (P. O. Box No. 1237), Rangoon, Burma; rubber, raw cotton, resin.

Fr. M. Daubitz, Gummiwerk, 91-95 Koepenickerstrasse, Berlin-Rudow, Germany; rubber goods such as surgical, dissecting, and technical gloves, rubber goods for hospitals, and meteorological balloons.

Siemens & Halske A.G., 4 Wittelsbacher Platz, Munich 2, Germany; cables and wires.

National Toy Co., Ltd., No. 6, 7-chome, Kobi-ki-cho, Chuo-Ku, Tokyo, Japan; rubber toys.

Samuel Saul Marshall, representing Libroc Engineering Pty. Ltd., 133 Princess Highway, Arncliffe, New South Wales, Australia; automobile accessories.

Export Opportunities

Goos' Handelonderneming, 2 Boompjes, Rotterdam, Netherlands; polyvinyl resins and plastics, chlorinated rubber.

André Cohen, 18 Ave. Alapetite, Tunis, Tunisia; auto parts, tires.

G. Doucedame & Cie., 24 Blvd. Faiderherbe, Cambrai (Nord), France; rubber footwear.

Paul Reveyaux, 10 Rue du Cloître de la Barge, Amiens (Somme), France; tennis shoes, rubber boots.

Globe Garage & Automotive Service Station, 112 Rue des Mexique, Tangier, Morocco; automotive supplies including batteries, brake linings, accessories, and tires, automotive maintenance shop equipment.

Is. S. Hagouel, 33 Komninos St., Salonika, Greece; rubber gloves and other rubber articles for medical use.

The African Rubber Co., P. O. Box 825, Sahel el Guelal, Boulac, Cairo, Egypt; neoprene.



Tokyo Rubber Goods Trading Co., Ltd., 9, 4-chome, Kitagasa-dori, Ikutaku, Kobe, Japan; carbon black for rubber factories.

Sheffield Staalhandel, 69 Lange Nieuwstraat, Schiedam, Netherlands; grinding wheels.

OTS Bibliography Reports on Rubber Products — XX

THE reports and abstracts thereof given below are taken from the Department of Commerce's monthly publication, "Bibliography of Scientific and Industrial Reports." Reports available in microfilm, enlargement print, or photographic form may be obtained from the Library of Congress. Photoduplication Service, Publication Board Project, Washington 25, D. C., with accompanying check or money order payable to the Librarian of Congress. Reports available in printed or mimeographed form may be obtained from the Office of Technical Services, United States Department of Commerce, Washington 25, D. C., with accompanying check or money order payable to the Treasurer of the United States.

Laboratory Test Reports on Mixtures of Igelit PCU (P.V.C.) and Various Plasticizers (Products SK 94 to SK 470). I. G. Farbenindustrie A.G., Schkopau, PB-100827, 1943-1944, 256 frames. Microfilm \$9; enlargement print \$33.75. Text in German. (English abstract available as PB-100827s; 2 pages; microfilm \$1.25, photostat \$1.25.)

Experiments Relating to the Application of the Carbon Dioxide, Acetic Acid, and Bisulfite Precipitation Methods in the Manufacture of Buna S Free from Linoleic Acid. I. G. Farbenindustrie A.G., Leverkusen, PB-100833, October, 1942, 10 frames. Microfilm \$1.25; enlargement print \$2.50. Text in German (English abstract included).

Laboratory Test Reports on Mixtures of Igelit PCU (P.V.C.) and Various Plasticizers. I. G. Farbenindustrie A.G., Schkopau, PB-100938, 1941-1944, 153 frames. Microfilm \$6; enlargement print \$21.25. Text in German. (English abstract available as PB-100938s; 2 pages; microfilm \$1.25, photostat \$1.25.)

Research in the Manufacture of Buna. I. G. Farbenindustrie A.G., Schkopau, PB-100832, 1940-1944, 27 frames. Microfilm \$2; enlargement print \$5. Text in German (English abstract included).

Emulsion Polymerization of Butadiene to Synthetic Rubber. Erich Konrad and Wilhelm Becker, I. G. Farbenindustrie A.G., Leverkusen, PB-100840, 62 frames. Microfilm \$3; enlargement print \$10. Text in German (summary in English).

Vulcanizing Equipment, Vulcanization Process, and Testing of Vulcanized Products. I. G. Farbenindustrie A.G., Schkopau, PB-100841, 1941-1944, 21 frames. Microfilm \$2; enlargement print \$5.

United States Rubber Industry Employment, Wages, Hours

Prod. Work- ers 1000's	Ave. Week- Earnings	Ave. Week- Hours	Ave. Hour- Earnings	Con- sumers Price Index
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All Rubber Products

1939	121	\$27.84	39.9	\$0.745	99.4
1948	209	56.78	39.0	1.456	171.2
1949	186	57.79	38.3	1.509	169.1
Sept.	167	61.01	40.3	1.514	169.6
Oct.	187	59.57	39.4	1.512	168.5
Nov.	186	57.91	38.4	1.508	168.6
Dec.	187	59.04	39.2	1.506	167.5
1950	187	60.52	39.4	1.669	166.9
Jan.	188	59.90	39.2	1.528	166.5
Feb.	189	59.70	39.3	1.519	167.0
Mar.	190	61.76	40.0	1.544	167.3
Apr.	194	64.52	41.2	1.566	168.6
May	199	65.08	41.4	1.572	170.2
June	200	66.19	41.5	1.595	172.5
July	209	67.61	42.6	1.587	173.0

Tires and Tubes

1939	51.2	\$33.36	35.0	\$0.957	
1948	96.2	\$2.16	37.2	1.671	
1949	83.6	63.26	36.4	1.738	
Sept.	64.3	69.95	39.1	1.789	
Oct.	81.1	64.83	37.3	1.738	
Nov.	81.3	63.91	36.9	1.732	
Dec.	82.1	64.79	37.3	1.737	
1950	82.6	67.70	38.4	1.763	
Jan.	83.1	67.22	38.3	1.755	
Feb.	83.4	65.26	37.4	1.745	
Mar.	84.0	69.23	39.0	1.775	
Apr.	85.9	74.60	41.1	1.815	
May	88.0	74.05	40.6	1.824	
June	87.7	76.30	40.8	1.870	
July	89.6	78.35	41.9	1.870	

Rubber Footwear

1939	14.8	\$22.80	37.5	\$0.607	
1948	24.6	51.75	41.8	1.238	
1949	21.6	48.94	38.6	1.268	
Sept.	21.1	51.71	40.4	1.280	
Oct.	21.5	49.81	39.1	1.274	
Nov.	22.2	50.51	39.9	1.266	
Dec.	22.1	50.23	39.8	1.262	
1950	20.1	45.87	35.7	1.285	
Jan.	18.8	43.06	34.2	1.259	
Feb.	19.4	51.04	40.0	1.276	
Mar.	19.3	50.36	39.5	1.275	
Apr.	19.1	50.20	39.4	1.274	
May	19.3	52.07	40.3	1.292	
June	19.2	52.13	39.7	1.313	
July	20.7	54.27	42.3	1.283	

Other Rubber Products

1939	51.9	\$23.34	38.9	\$0.605	
1948	88.1	52.47	40.3	1.302	
1949	80.9	54.38	40.1	1.356	
Sept.	81.4	56.50	41.3	1.368	
Oct.	84.4	57.06	41.5	1.375	
Nov.	82.8	54.04	39.5	1.368	
Dec.	83.1	55.66	40.9	1.361	
1950	84.5	57.04	41.3	1.381	
Jan.	86.3	56.43	41.1	1.373	
Feb.	86.2	56.16	40.9	1.373	
Mar.	87.2	57.13	41.1	1.390	
Apr.	88.8	57.92	41.7	1.389	
May	92.0	59.23	42.4	1.397	
June	92.7	59.60	42.6	1.399	
July	98.2	60.48	43.2	1.400	

SOURCE: BLS, United States Department of Labor, Washington, D. C.

United States Rubber Statistics — October, 1950

(All Figures in Long Tons, Dry Weight)

	New Supply			Distribution		Month- End Stocks
	Production	Imports	Total	Consumption	Exports	
Natural rubber, total	0	73,215	73,215	63,646	564	77,998
Latex, total	0	5,161	5,161	5,532	0	5,238
Rubber and latex, total	0	78,376	78,376	69,178	564	83,215
Synthetic rubbers, total	1,377,994	1,584	1,377,994	1,584	54,507	51,751
GR-S types	1,696	1,187	34,367	42,482	35	36,483
GR-S types	762	397	5,973	6,559	7	7,211
Butyl	4,576	0	4,576	4,323	476	5,166
Neoprene	14,677	0	14,677	14,323	374	2,891
Nitrile types	11,257	0	1,257	1,143	149	2,891
Natural rubber and latex, and synthetic rubbers, total	44,690	79,960	124,650	123,685	1,231	134,966
Reclaimed rubber, total	32,685	25	32,710	32,785	989	33,530
GRAND TOTALS	77,375	79,985	157,360	156,470	2,220	168,496

*Government plant production.

†Private plant production.

SOURCE: Rubber Division, ODC, United States Department of Commerce, Washington, D. C.

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In servicing the rubber industry for over 40 years, Muehlstein has gained valuable experience with which to suggest new uses for old products . . . old uses for new products.

Today during a period of scarcities, our laboratories may have a suggestion which will insure continued production of your products. Contact the nearest Muehlstein office today.

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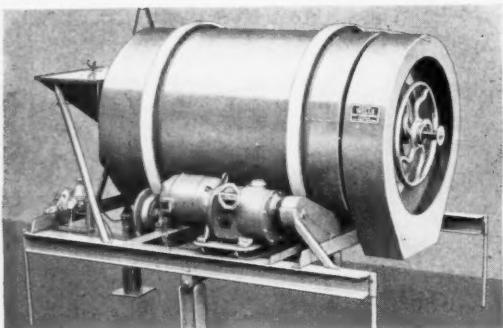
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WILLS

"SUB-ZERO" ROTARY TUMBLERS



FOR PRODUCTION DEFLASHING OF MOLDED RUBBER ITEMS

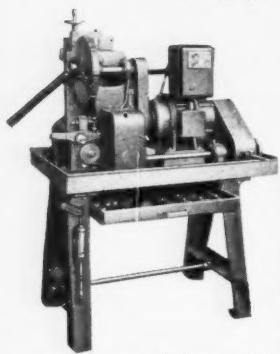
Holds lowest temperature, with minimum "Dry Ice" consumption, by reason of our method of complete insulation. Has wide loading end hopper. Unloads automatically into tote boxes or conveyor. Product can be inspected while tumbler is rotating. Equipped with variable speed control motors. Ruggedly constructed, available in two sizes. Suitable for use with other deflashing aids or dry tumbling.

FERRY MACHINE COMPANY

WILLS RUBBER TRIMMING DIVISION
KENT, OHIO, U.S.A.

(Export Sales Through Binney & Smith, International)

For Immediate Shipment.. Thropp Automatic Washer Cutters



THE Thropp Automatic Washer Cutter does not require mandrels. It will cut washers for hose connections, bottle stoppers, plumbers' washers, synthetics, uncured stock for molds, etc. A single unskilled operator can run

one or more of these machines at the same time. Size of Cuts: $\frac{1}{4}$ " in diameter to $\frac{13}{16}$ " inclusive, and from $3\frac{1}{32}$ " to $1\frac{1}{2}$ " in length.

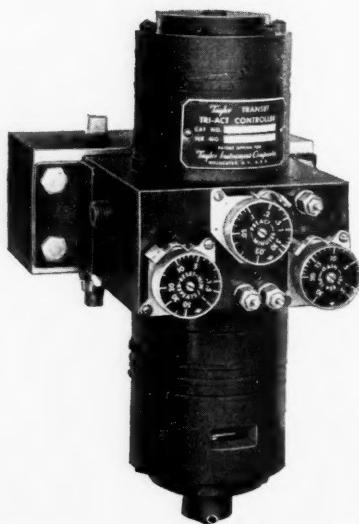
Capacity: 100 cuts per minute on long lengths and big diameters; and 200 cuts per minute on narrow widths and small diameters.

Shipment: Shipment can be made from stock on a limited number of units complete with motor and control, wired and ready for installation.

- West Coast Rep.: H. M. Royal, Inc., Los Angeles, Cal.
- Export Agent: Steinhardt & Nordlinger, 105 Hudson St., N. Y.

THROPP
WM. R. THROPP & SONS CO. Trenton, N.J.

New Machines and Appliances



Taylor's New Transet Tri-Act Controller

New Controlling Instrument

THE Transet Tri-Act Controller, a new force-balance, non-indicating controller for pneumatic transmission systems, has been announced by Taylor Instrument Cos., 95 Ames St., Rochester 1, N. Y. For either local or panel mounting, the controller is suitable for use on temperature, pressure, flow, or liquid level applications.

Supplementing the recently announced Transaire temperature and pressure transmitters and the miniature Transet recording receivers, the new controller completes the Transet control system to give: (1) faster and more accurate measurement of rapidly changing temperatures and pressures; (2) closer process control; and (3) continuous process records on a 30-day strip chart. In addition, the instrument provides all other features needed for efficient remote control, all in a $4\frac{1}{8}$ - by 5-inch miniature pneumatic receiver.

The controller utilizes a new type of circuit which permits a reset rate and rate action four times faster than conventional instruments. Other features include a high-capacity relay air valve to give faster output action; self-sealing manifold to simplify piping and maintenance; wide range of control response adjustments; non-rotating-type needle valve on the adjustment dials; built-in orifice cleaners and air strainers; and convenient alignment adjustments.

Rubber Notes from Colombia

The establishment of consumption quotas and minimum prices for wild rubber and latex produced in Colombia has resulted in increased collection during the first half of 1950, when the amount harvested is estimated to have been about 400 metric tons, or equal to that of the whole of 1949. It is expected that 550 more tons will be collected in the second half of this year, bringing the crop of wild rubber for 1950 close to the level attained during 1943-46.

According to a recently passed resolution, import licenses of rubber thread must be approved by the Colombian Ministry of Commerce & Industries, and approval will only be granted if the prospective consumer can prove that quality or quantity of domestic thread does not meet his requirements.

Shafts take a turn for the better on pillow blocks with TIMKEN® bearings

WITH shafts turning on Timken® bearings, you're assured of long, trouble-free service, virtually friction-free operation, and minimum maintenance, even under the heaviest loads.

Line contact between rollers and races gives Timken bearings extra load-carrying capacity. True rolling motion and incredibly smooth surface finish make friction practically negligible. Shaft wear is eliminated. And because of tapered construc-

tion, Timken bearings can take radial and thrust loads in any combination.

Tighter closures are permitted that keep lubricant in—dirt and moisture out. Lubrication and maintenance costs are reduced.

Timken bearings are made of the finest steel ever developed for tapered roller bearings—Timken fine alloy steel—and under normal conditions will last the life of the equipment with which the pillow blocks are used.

Backed by half a century of bearing research and development, Timken bearings are first choice throughout industry. If you need pillow blocks, specify those equipped with Timken tapered roller bearings. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ont. Cable address: "TIMROSCO".



This symbol on a product means its bearings are the best.



The two DODGE-TIMKEN pillow blocks shown here are the largest and smallest stocked by the Dodge Manufacturing Corporation, Mishawaka, Ind. At 500 R.P.M. the large 8" pillow block has a 30,620 pound capacity, and the 13½" size can take a 2,310 pound load. Timken tapered roller bearings are used exclusively in Dodge-Timken pillow blocks.

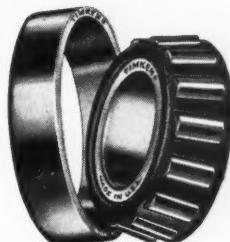


WE MAKE OUR OWN STEEL

The special grade alloy steel which gives Timken bearings their strength and resistance to wear, is made in our own steel mills.

The Timken Roller Bearing Company is the acknowledged leader in: 1. advanced design; 2. precision manufacturing; 3. rigid quality control; 4. special analysis steels.

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They represent the ultimate in red iron oxide colors for the rubber industry.

Williams iron oxides come to you with all the benefits of our 72 years in the pigment business . . . and as a result of our experience in producing pure red iron oxides to specifications of the leading rubber companies.

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Whatever your color problem, bring it to Williams. Our 72-year experience can often save you time, money, and headaches in proper color formulation.

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New Goods and Specialties

Tire for Corn Planters

A NEW special tire for corn planters, embodying one of the most novel designs ever included in a pneumatic casing, has been developed by The B. F. Goodrich Co., Akron, O. Shown in tests to outperform the steel wheels which have been conventional equipment on planters, the new tire is constructed with high shoulders and lower center and retains that shape when inflated to the recommended pressures of four to eight pounds.

The steel wheel ordinarily used on planters is designed so that its two outer rings press the soil back into the furrow after the seed has been dropped. When worked in moist soil, these steel wheels build up soil on their surfaces and give inadequate and uneven covering for the seed. In tests the new tire has been shown to have the following advantages: (1) seed can be planted satisfactorily under wet soil conditions; (2) the rubber tire gives better firming of the soil and uniform planting depth; (3) cushioning the planter on rubber reduces vibration and shock; (4) the tire gives less sideslip on hillside planting; (5) the tire exerts a slight pressure directly on the seed and eliminates air pockets during planting; and (6) the tire produces much less dust in dry soil than does the steel wheel. The new tire is mounted on a standard drop-center rim on a light-weight wheel especially developed for this purpose.

Goodrich further reported that in a series of controlled tests on corn, on adjacent plots where the same seed was sown, seed planted by a vehicle equipped with the new rubber tires germinated from two to four days faster than that planted by a vehicle equipped with steel wheels. Speedier germination gives the corn an advantage over weed growth since it can be cultivated earlier.



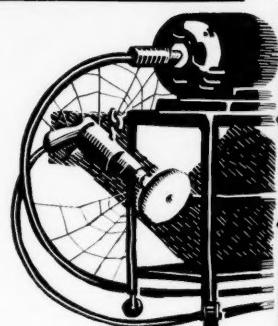
New Goodrich Tire for Corn Planting Machines



High Conductivity

SEE PAGE 512

This is how Mold Cleaning Departments Make Profits



Molds lubricated with Dow Corning Silicone mold release agents stay clean 5 to 20 times as long as they ever did before. That's because Dow Corning Silicones can't break down to form a carbonaceous deposit on the molds. Furthermore, mold dirt won't stick to a silicone surface. Mold maintenance is therefore reduced to the vanishing point. Molds last longer and you get easier release

of parts with a uniformly better finish and sharper detail. Close tolerances are maintained at minimum cost. That's why most of the tires and a lion's share of all the mechanical rubber goods, heels and soles, floor tile and mats produced in this country are released from molds sprayed with DC Mold Release Emulsions or with a solvent solution of DC Mold Release Fluid.

FOR MOLDS THAT STAY CLEAN

SPECIFY DOW CORNING SILICONE RELEASE AGENTS



Dow Corning Silicones Mean Business!

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Sun's wide selection of "Job Proved" petroleum products, plus the vast experience of Sun Engineers, can help you cut costs, step up production, and improve quality. Every Sun product, after its development in the laboratory, must pass rigid and exhaustive tests in actual use. When the worth of the product has been completely demonstrated in this way, then—and then only—it is given the "Job Proved" stamp and offered for sale. Detailed product information and the help of Sun Engineers are yours for the asking. Call your local Sun Office.

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Original charge of Sunvis as good as new after three years' use in hydraulic press.

SUNVIS 900 OILS—Unexcelled for turbine lubrication, for use as a hydraulic medium, for circulating systems and similar applications requiring longest possible oil life, plus maximum protection to equipment. Sunvis 900 Oils have a high viscosity index and uniform 0°F. pour point, and are fortified against corrosion and oxidation.

SUNVIS OILS—Give long, trouble-free service in all types of industrial reservoirs and circulating systems operating at normal temperatures. Sunvis Oils have uniform high viscosity index, low pour point, and low carbon content.

SUNVIS H.D. 700 OILS—For internal combustion engines operating under heavy-duty conditions, or where hydraulic valve-lifters are used; for circulating systems and other industrial applications where contamination is a factor. The additives in Sunvis H.D. 700 Oils supply detergency, and minimize oxidation and corrosion.

SUNVIS 800 OILS—Special heavy-duty lubricating oils used in railroad diesel engines equipped with silver-alloy bearings.

SUNVIS 2200 AND SUNVIS 2300—Heavy-Duty Supplement #1 and Supplement #2 quality oils respectively. For use in diesel engines where high-sulfur fuels may be encountered.

DYNAVIS OILS—For internal combustion engines operating at moderate loads and speeds. These low-pour-point, high-viscosity-index, inhibited oils help prevent formation of harmful corrosive and sludge-forming acids.

CIRCO OILS—Straight mineral oils for general lubrication of industrial machinery. Unsurpassed for once-through applications, regardless of operating temperatures.

SUNTAC OILS—Recommended for general lubrication of all machines subjected to sudden shocks and load reversals. Compounded to increase adhesiveness, Suntac Oils cling to bearing surfaces and supply constant, superior lubrication.

STEAM CYLINDER OILS—Lubricants of high flash and fire point for saturated or superheated steam conditions and for worm gear speed-reduction units.

SUNOCO WAY LUBRICANT—Eliminates "stick-slip" of tables and scoring of ways. Noncorrosive, with outstanding metalwetting and adhesive properties, ample viscosity and E.P. qualities. Approved by 36 leading machine tool manufacturers.

ROCK DRILL OIL—High-film-strength oil for use in jackhammers, stoppers, drifters, and similar equipment.

INDUSTRIAL GREASES



Sun grease increases steel mill production by cutting bearing failures 92%.

SUN GUN GREASES—Smooth greases made with medium-viscosity oil. Stable under pressure in power and booster guns.

**"JOB PROVED" IN
EVERY INDUSTRY**

SUN

SUN ADHESIVE PRESSURE GREASES—Won't drip or splash. Excellent lubricants for open-gear applications.

SUN DARK PRESSURE-SYSTEM GREASES—For power-driven central grease lubricating systems in heavy industries. Also used as "medium cup greases."

SUN MINE CAR GREASES—Available in several grades. Suitable for both antifriction bearings and plain-bearing cavity-type wheels.

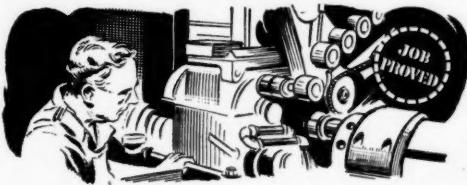
SUN MINING MACHINE LUBRICANT—Semifluid. For use where a light but adhesive grease is required. Resists separation and decomposition.

SUN ROLLER BEARING GREASES—For use on electric motors and generators and high-temperature machinery equipped with ball or roller bearings.

SUN GEAR COMPOUNDS—Black adhesive open-gear compounds and wire-cable greases. Recommended for power presses, mining machinery, wore reduction mills, crushers, pump gears, etc.

SUNOCO TRACTOR ROLLER COMPOUND—For crawler-type tractors. Provides good lubrication with exceptional sealing qualities.

METALWORKING OILS



Ball bearing manufacturer finds that Sunicut increases tool life 15%, eliminates sludging.

SUNICUT—Straight (non-emulsifiable) transparent cutting oils. Various grades for automatic screw machines and heavy-duty machining operations. Permit high speed production with excellent finishes, long tool life.

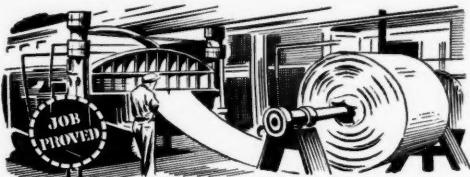
SUNOCO EMULSIFYING CUTTING OIL—An emulsifiable oil which produces a stable white emulsion. Efficient and economical cooling and lubricating medium for turning, milling, drilling, and other metalworking operations on both ferrous and nonferrous metals. It is also an excellent grinding coolant. Available in heavy-duty grades too.

SUN QUENCHING OILS—Specially refined oils designed to aid development of maximum physical properties in a wide variety of steels.

SUN TEMPERING OILS—Specially refined oils for tempering steel. Because of their low carbon content and stability under heat, these oils have an unusually long service life.

SUN ROLLING OILS—Straight and emulsifying oils which will permit maximum production in rolling steel, aluminum, brass, and copper.

RUBBER-PROCESS AIDS



Two Sun rubber-process aids save manufacturer \$6,000 a year by taking the place of five competitive products.

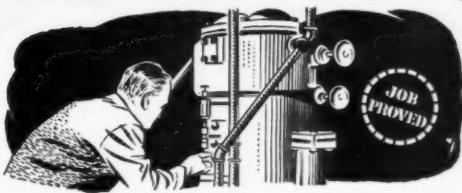
CIRCOSOL-2XH—An elasticator and process aid for natural rubber and especially for GR-S. Outstanding for sponge rubber.

CIRCO LIGHT PROCESS-AID—A processing agent and excellent softener for natural rubber, natural rubber reclaims, and neoprene synthetic rubber. Used for GR-S to some extent.

SUNDEX-53—An inexpensive product suitable for processing GR-S and blends of GR-S and natural rubber. An established process aid for rubber footwear stocks and semihard rubbers.

CIRCOMAR-5AA—A dark-colored product for processing natural and GR-S rubber used in tire-making. Also used in reclaiming natural-rubber scrap. Replaces asphalt fluxes. Free-flowing at room temperature.

REFRIGERATION OILS



Hotel turns to Suniso for its ice-making equipment; eliminates separation troubles, cuts oil costs 20%.

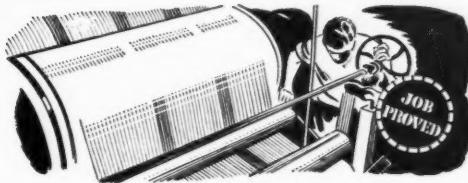
SUNISO REFRIGERATION OILS—High-quality oils having extremely low pour points, extremely low wax-separating characteristics, a high degree of stability, and long life. Initially neutral and resistant to formation of detrimental acids. Suniso grades are available to meet all low, normal, and high temperature conditions. The most widely used oils in refrigerating and air-conditioning.

SUNOCO WAXES

Waxes, "tailor made" to provide the exact properties demanded by different industries, are now available from Sun's new multimillion-dollar wax plant. Revolutionary manufacturing methods make it possible to retain only the wax portions desired for a particular use, while discarding those which might be detrimental.

Sunoco Waxes are precision-controlled for quality and uniformity of all physical and chemical characteristics important to the user. The various grades of Sunoco Wax are recommended on the basis of their ability to give superior performance on the specific job.

TEXTILE OILS



Sunotex replaces three formula components in textile mill; also saves 25% on costs.

SUNOTEX TEXTILE-PROCESS AIDS—Designed to impart desired additional properties to various fibers during their processing from the raw state into a manufactured product. All Sunotex textile-process aids are emulsifiable in water. Highest rating in Fade-Ometer tests.

SUN COTTON CONDITIONERS—Processing materials which prevent waste by cutting down excessive amounts of fly (fine air-borne lint particles).

SUN ASBESTOS FIBER CONDITIONER—Sprayed on asbestos during processing to keep fibers from being damaged or broken down. Harmful dust is minimized when this product is used.

SUN CORDAGE OILS—Generally used alone, but adaptable to various formulas used by cordage manufacturers. Selected products, highly compatible with additives.

SUNOTEX MACHINE OIL—One lubricant for nearly every kind of textile machine. A high-quality mineral oil and additive combination which prevents rust, clings to moving parts, and minimizes wear. Scours out of all kinds of fabrics easily and completely.

ADDITIONAL INDUSTRIAL PRODUCTS

SUN SOLVENTS—Sun Spirits for the thinning of paints, varnishes, and enamels, for metal-cleaning, and certain types of processing and extraction... a pure, water-white petroleum solvent free of corrosive sulfur. Other Sun solvents with special properties are available for the chemical industry.

SUN LEATHER OILS—Petroleum-base leather oils. Used for obtaining the desired tensile strength, proper temper, and controlled moisture content. Maintain a light even color, mix well, and distribute evenly.

INDUSTRIAL PRODUCTS



CAPITOL LINER PROCESS and the Current Cotton Goods Shortage

It may be your type of manufacture has not required the use of treated liners. However, liners eventually have to be replaced.

Because of the shortage of cotton piece goods, which promises to last for some time, the obtaining of liner material is a very serious problem.

Here is where real consideration of Capitol Liner Process should come into the picture. Our treatment of cotton piece goods will materially enhance their life and usefulness many, many months over untreated liners.

We are prepared to finish your goods or furnish complete treated liners in limited quantities if you so desire.

We also mildewproof, flameproof and waterproof cotton fabrics.

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Originators of
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Process



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GREAT BRITAIN

Recent Rubber Developments

Rubber Developments, the quarterly prepared by the British Rubber Development Board, and issued in the United States by the Natural Rubber Bureau, Washington, D. C., in its December, 1950, issue presents new trends in the application of rubber and mentions examples of progress in Britain.

There is described, what is claimed to be a revolutionary, new method of bonding rubber to metal, the so-called Redux process. The basic idea of the process, treatment of the rubber surface with concentrated sulfuric acid before bonding and then washing in running water, stems from a patent taken out by Charles Woodward in 1882 for improving the adhesion of rubber. The surface is "cylized," being hardened a little and covered with fine cracks or "crazing" noticeable only when the rubber is bent, and the chemical change of the surface gives the rubber better adhesive properties.

As developed by Aero Research, Duxford, Cambridge, England, the method involves painting the washed and dried rubber with a thin coat of Redux liquid resin. The metal surface is thoroughly degreased, shot-blasted or chemically cleaned, and Redux liquid is applied by brush, followed by dipping of the coated surfaces into Redux powder.

The rubber and the metal are then clamped together under a pressure of 50 pounds per square inch and heated at 140° C. for 20 minutes. The precise time depends on the position of the glue line.

The process is primarily used with hard rubber, but variations have been worked out for use with soft rubbers also, in which Redux or Ardux 120, an emulsion developed from Redux, together with an accelerator is employed at reduced temperature and pressure. Rubber can be bonded to other plastics by the same method, for instance to Bakelite, Tufnol, Delaron, etc.

It is expected that the new development will help solve many problems in tanks, washing machines, and the like, where a rubber lining is desirable, but usually avoided because of the difficulties involved. The method may also lead to the use in chemical plant of rubber-bonded construction sheets, which would be simpler than the present practice of constructing plant first and lining with rubber later.

Also described in *Rubber Developments* is a new torsional shear suspension claimed to improve bus riding qualities. This suspension, developed by Birmingham & Midland Motor Omnibus Co. in cooperation with Metalastik, Ltd., is designed on the toggle link principle, employing large-diameter circular rubber bushes to make the most efficient use of the qualities of rubber and the possibilities of bonding it to the metal. Each complete suspension unit includes four bushes which, when the vehicle is empty, lie in the same horizontal plane so that the weight of the vehicle is carried entirely by these with the rubber in torsional shear.

Likewise given is a rather thorough treatment of the use of rubber in the British shoe industry, especially as exemplified by products shown at the Shoe & Leather Fair, held at Olympia, London, September 11-15, 1950. We note composition soling material, simulating leather, soling materials of rubber combined with wool fibers, cork rubber compositions; various applications of sponge rubbers, as molded soles, padding for ski-boots, molded arch pads, heel pads for use between the wooden heel block and the mid-sole; and, of course, Wellingtons and other boots and shoes, including an all-rubber golf shoe.

A two-day course devoted mainly to the uses of latex in combination with textiles, held in England last September under the auspices of Rubber Technical Developments, a joint unit of the British Rubber Producers' Association and the British Rubber Development Board, is duly reviewed in the foregoing publication. The techniques involved in impregnating, spreading, calendering, and doubling, uses of latex for carpet backing and underlay, treatment of gas-impermeable fabrics, the manufacture of artificial silk and the Positex process of treating wool with reverse-charge latex, all come in for discussion. We note mention of the fact that attempts to use synthetic resins for increasing the adhesion between the fibers in wool textiles had not given satisfactory results.

The publication under review calls attention to various new rubber-asphalt road experiments recently undertaken in various parts of the United Kingdom. A series of surfaces was laid in the vicinity of Ashcott, and another series in the Taunton rural area, both in the county of Somerset; Scotland's first postwar



Precision

IS AS MUCH A MATTER OF MEN AS OF MACHINES

MUCH of the ability of BRIDGWATER to produce economically tire molds of whatever characteristics the industry requires is due to the many special machines we have designed and built.

But the mirror like finish, the sharp, precise corners, the accurate template fit to all characters and ribs in the design, characteristic of molds by

BRIDGWATER, are as much a matter of men, as of machines.

Put the two together: special machines designed to perform specific functions quickly and accurately, plus craftsmen skilled by years, enthusiastic by nature, and conscientious by habit, and you have the basic reason why we believe tire molds by BRIDGWATER are unsurpassed anywhere in the world.

ATHENS MACHINE DIVISION
THE BRIDGWATER MACHINE COMPANY
Akron, Ohio

FOR BETTER MOLDS FOR BETTER TIRES SPECIFY BRIDGWATER



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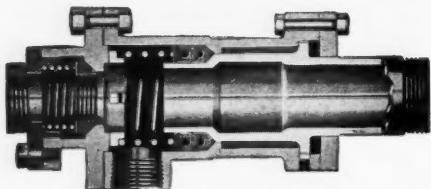


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rubberized road was laid on the Wellington Suspension Bridge across the River Dee at Aberdeen in last September; additional stretches of rubber-asphalt roads have also been laid within the last few months in Leeds; Knolly's Road, Lambeth, London; Westgate Bradford, and Toller Hill, also in Bradford; and finally at Chestnut Road, Plymouth.

Carbon Black and Fuel

At a joint meeting of the Fuel (Midlands Section) Institute and the Institution of the Rubber Industry, in Birmingham on December 6, 1950, a paper "Fuel Aspects of Carbon Black Manufacture" by C. A. Stokes, director of research and development, Godfrey L. Cabot, Inc., Boston, Mass., U.S.A., was presented and read by N. D. Steele, assistant director of the development division of the Cabot group of companies. The subject was especially interesting to the British audience since carbon black, formerly imported from America, is now being produced here (from imported fuel), among others by Cabot Carbon Co., Ltd., Ellesmere Port, Cheshire. This company is presently manufacturing about 1,000,000 pounds of highly reinforcing black from oil a month.

FRANCE

A method¹ has been developed at the Institut Français du Caoutchouc to produce cellular rubber from latex in which blowing and surface-active agents are incorporated in the latex and expansion occurs in the mold after heating, contrary to usual present practice in which a froth is produced by beating heat-sensitized latex before heating.

Tests with various types of organic blowing agents—aryldiazoinine (Porofor DB), azoisobutyronitrile (Porofor N), Porofor BSH, dinitrosopentamethylenetetramine (Vulcacel BN, Genolat)—indicated that the dinitroso derivatives best answer the requirements of a good blowing agent for latex: rapid and very exothermic pyrolysis; production of strong local pressure, and initial decomposition temperature in the latex of 60 to 100° C. with liberation of nitrogen. In practice 2% of the blowing agent was found the most suitable proportion; the resulting products have densities of 0.14–0.15, and even 0.10.

Since the use of blowing agents renders the latex heat-sensitive, surface active agents must be introduced into the latex to prevent premature gelling. In testing such substances, not only their stabilizing action, but also their dispersion and expansion qualities were considered. Sodium salts of oleic, cetyl, and lauric acids, as Stanopon OC and LCH, Vulcastab LS, Cemulsol T, and Neosapol, all gave good results; the proportions used ranged from 0.1 to 1%, depending on the action of the individual product and the initial stability of the latex.

The dispersions of vulcanizing ingredients, swelling and surface active agents that must be incorporated add water to the original 60% latex, and it was found that increasing amounts of water have the effect of making the pores larger and more irregular; above 15% of water on the total volume of latex and ingredients, large pockets form in the interior of the spongy mass.

After the mixture is poured into the molds (making due allowance for expansion), heating should be gradual so that a temperature of 125 to 130° C. inside the molds is reached in 20 to 30 minutes.

At the I.F.C. the following procedure was worked out:

First a dispersion of the following ingredients is prepared by treatment in a ball mill for 70 hours:

	Grams
Zinc oxide	300
Sulfur	200
Diethylthiocarbamate of zinc	100
Distabex L (Francolor)	24
10% solution of sodium algum	180
Distilled water	1200

Of this dispersion 7.2 grams are added to 100 grams of 60% latex, with which a paste of the blowing and surface active agents (1.2 grams of dinitrosopentamethylenetetramine and 0.6 gram of Stanopon OC) in a little water, has been mixed. The latex is poured into the molds, preferably aluminum, placed into an oven heated to 140–150° C., removed after 30 minutes, and left in freely circulating air for a few days to dry out.

A comparison of a sample of cellular rubber prepared in this

¹ C. Pinazzi, *Rev. gén. caoutchouc*, 27, 12, 725 (1950).

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way with ordinary foam rubber shows these differences: the openings in the former tend to be spherical and regularly disposed; whereas those in the latter are more elongated and irregular; in the former, the greater the density, the greater the tendency to form a closed cell structure of very fine regular cells; while in low densities, the structure is spongy, but density is higher at the surface than in the center, which, it is pointed out, may have mechanical advantages. The I.F.C. rubber is stronger than the foam rubber; aging in sunlight is at least as good as that of the older type, and the same is true of the resistance to sun and weather combined. It is noted that the addition of 3% of dibutyl-dithiocarbamate of nickel gave marked protection against the effects of sunlight; I.F.C. rubber thus protected and exposed to sunlight for 45 days compared very favorably with a control sample kept in the dark for the same period of time. Contraction on cooling seems to have the effect of producing wrinkles on the underside of the molded article, but it was found that this defect could be largely overcome by heating in an autoclave by indirect steam heat.

Among the uses for the material suggested are cushions and shock absorbers; the possibility is also indicated that the process may help solve certain problems in connection with the covering of fabrics or metal surfaces with a sponge rubber layer. It seems to be the plan to undertake the production of certain simple articles on a semi-industrial scale.

AUSTRIA

The Austrian rubber industry reports increasing activity in practically all lines of rubber goods manufacture, with overall output up to 9,323 tons in the first half of 1950, as compared with 6,772 tons in the corresponding period of 1949. The following table shows the production of tires and tubes during the first six months of 1950:

For	Tires	Tubes
Passenger cars	units	
Trucks, buses, tractors	59,949	76,092
Motorcycles	59,618	76,296
Bicycles	41,006	55,694
	938,663	751,258

Figures for 1949 are not available for comparison, but increases in each type took place in 1950.

The development in production of other rubber goods is shown in the table below:

	First Half	1949
Footwear	prs.	1,133,529.0
Rubber soles and heels	tons	886,346.0
Hose	tons	362.6
Belting	tons	566.1
		380.0
		211.1
		173.0

Decreased demand in heels and soles led to the sharp drop in output in 1950 revealed in the table.

A plastics exhibition and plastics conference were arranged in connection with the Vienna Fall Fair held September 10-17. The exhibition showed a good range of articles including household

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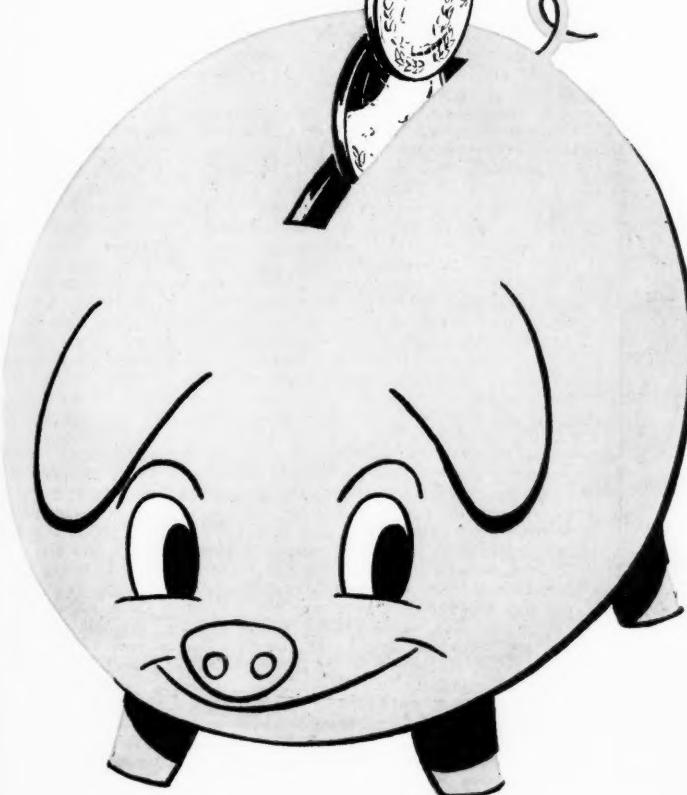
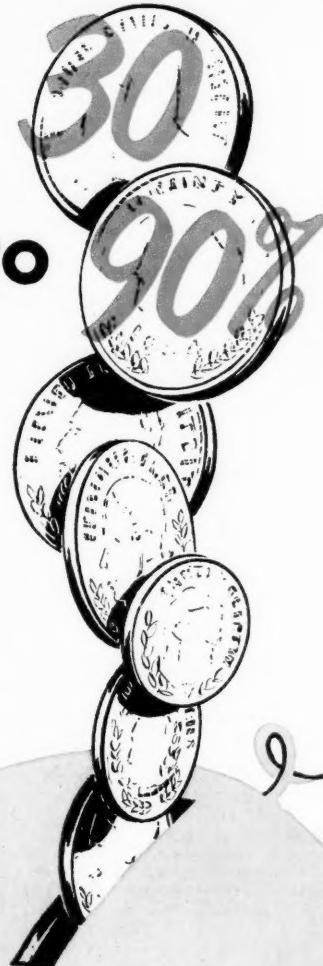
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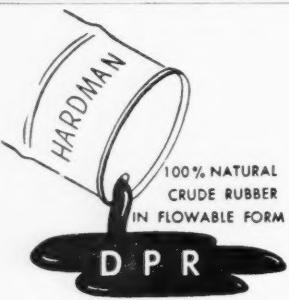
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The plastics meeting was held on September 12 and 13 and altogether 13 papers were presented, including five by German experts from the Western zone of Germany and one on I.C.I. plastics by Mr. Renfrew of London, who read in German. In the course of the welcoming address of Herr Pessl, of Vienna, on "General Survey of Plastics," it was revealed that Austrian annual output included about 3,500 tons of molded goods from powders.

At present polymerization plastics have to be imported, but it is planned to produce polyvinyl chloride here eventually. About 100 firms of different sizes engaged in the production of plastic goods employ altogether some 9,000 persons.

A factory for the production of polyvinyl plastics will soon be built at Hallein, Salzburg, by the Halvic Plastics Works, a subsidiary of Ebenseer Solvay Plastics Works, it is reported. The plant is expected to produce annually 1,500 metric tons of molding compounds.

POLAND

Poland is a comparatively late comer in the field of rubber goods manufacture for it was not until 1911 that the first rubber factory was established in Wolbrom, only to be damaged in World War I. Real development of the new industry could not take place until the early 1920's, but by 1939 there were several factories including some fairly large ones as Pe-Pe-Ge, Wolbrom, Gentleman, Stomil, and Kauszuk. At that time the industry employed some 15,000 persons (office and factory personnel) and produced roughly 14,000 tons of rubber goods annually, mainly footwear.

During World War II the industry had its second setback; some of the factories were more or less seriously damaged, but many more lost up to 80% of their equipment. When rubber manufacturing could be resumed after the war, the state of the factories combined with the shortage of machinery, raw materials, and trained workers, reduced productive capacity about 30% of prewar.

According to an article on the Polish rubber industry,¹ a few of the factories have meanwhile been completely restored, and others partly restored; among them Gentleman in Lodz, Stomil in Posen, Pe-Pe-Ge in Graudenz, Ragawar (formerly F. W. Schweikert) in Warsaw, Wolbrom in Wolbrom, Kauszuk in Bromberg, Piastow, near Warsaw, and the Semperit in Cracow, are now able to operate at least to some extent. The emphasis has now shifted from footwear to tires of all kinds, and the trend is said to be toward using more natural rubber and rayon instead of cotton cord. Stomil is the chief manufacturer of tires, but is due to be outranked by a new factory to be erected in Dembice as part of the six-year plan for 1950-1955 inclusive. This factory is to be equipped with the most up-to-date machinery, will have a capacity of 10,000 tons annually, and is expected to effect a fourfold increase in total tire output. No very recent figures of tire production are available, but the amount for 1948 is given as 4,572 tons; while 3,398 tons are reported for the first eight months of 1949.

The six-year plan also provides for an increase in the manufacture of other rubber goods to 13,000 tons by 1955; the present relatively insignificant production of rubberized fabrics and garments is to be increased sixfold; there is to be a 65% advance in the output of footwear; and mechanical rubber goods are to be tripled. It is proposed to raise the proportion of reclaim to 25% of the raw material used, and to permit this use a reclaim factory is to be erected with capacity of 6,000 tons. To carry out the six-year plan provision has also been made for a new factory for mechanical rubber goods and for extension to an existing factory of this kind; also for the purchase of a large quantity of machinery, most of which will be used to replace obsolete machinery and to modernize existing factories. More efficient methods will be studied and introduced.

To overcome the shortage of trained workers, numerous technical schools are being built, and many have already been opened in the vicinities of the big factories. Probably the greatest handicap Poland's rubber industry labors under now is the inadequacy of the country's production of machinery.

Poland has reportedly just entered the field of plastics manufacture and is said to have opened the first factory in Pomerania where Bakelite, and Vinylite goods are to be made and also artificial leather.

¹Kautschuk u. Gummi, Nov., 1950, p. 409.

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"**Colloidal Dispersions.**" Earl K. Fischer. John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Cloth, 5½ by 9 inches, 394 pages. Price, \$7.50.

Dealing with both the theoretical and practical aspects of colloidal dispersions, this monograph is based on the idea that the physical properties of dispersions and the requirements for their manufacture can be related to the nature and extent of the solid-liquid interface. The first five chapters cover the theoretical background, including particle size, the solid-liquid interface and wetting, the state of the dispersed solid, and rheological properties of dispersions. The remaining seven chapters discuss manufacturing details involved in the production of colloidal dispersions and cover such topics as surface-active agents, comminution, mixing, dispersion by phase transfer, and the different types of mills.

Intended as a supplement to other works on surface and colloid chemistry, this book will be of value to all workers in the field, whether concerned with theory or practice. Much of the information covers subjects which have not previously received adequate attention, such as dispersion by phase transfer. In addition, existing theories are evaluated, and many new interpretations and hypotheses advanced. Adding to the value of the book are the inclusion of many literature references and comprehensive author and subject indices.

"**Natural Gas Economics.**" Joseph A. Kornfeld. Transportation Press, P. O. Box 381, Dallas 1, Tex. Cloth, 6 by 9 inches, 275 pages. Price, \$5.

This book presents an authoritative study of the major economic problems facing the nation's natural gas industry. In systematic form the author discusses the role of natural gas in energy sources, its place in the national economy, and modern concepts of conservation. After a detailed review of the subject of synthetic fuels, there is a chapter devoted to underground natural gas storage. The subjects of reserves, production, and demand are discussed in succeeding chapters, with the various producing areas described in terms of supply, type of market, competing fuels, and price factors. Financial aspects of the industry, as well as price trends and factors influencing prices of natural gas are discussed in detail, and individual chapters cover transportation of natural gas and regulations on gas imposed by federal, state, and other bodies. Many figures and tables are used for illustrative purposes, and a bibliography and a subject index are appended.

"**Handbook of Chemistry and Physics.**" Thirty-Second Edition. Charles D. Hodgman, editor in chief. Chemical Rubber Publishing Co., 2310 Superior Ave. N.E., Cleveland, O. Cloth, 4½ by 7¼ inches, 2,899 pages. Price, \$7.50.

This newest edition of the standard handbook contains some 335 pages of new and completely revised material. Major revisions involving complete resetting have been made in the table of isotopes; letter symbols and abbreviations; description of the elements; periodic table; properties of commercial plastics; organic analytical reagents; potentials of electrochemical reactions; properties of amino acids; surface tension; vapor pressure; dielectric constants; and plate and film speeds. New additions to the handbook include tables on steroid hormones; electron work functions of the elements; centigrade-kelvin temperature conversions; and scientific and engineering abbreviations and symbols.

NEW PUBLICATIONS

"**Barco Flexible Ball Joints.**" Barco Mfg. Co., 1801 W. Winnemac Ave., Chicago 40, Ill. Catalog No. 215. 16 pages. This new catalog describes and illustrates the company's flexible ball joints, made in 12 styles and 15 different sizes for seven different types of service specifications. Data on design and dimensions are included together with information and photographs of typical applications.

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"General Purpose Emulsion Adhesive ARCCO 539-10A." Technical Data Sheet A33, American Resinous Chemicals Corp., 103 Foster St., Peabody, Mass. 2 pages. Information covers the specifications, properties, compounding, and uses of ARCCO 539-10A, an adhesive designed for the production bonding of materials that cannot be adhered with conventional animal, vegetable, or latex cements.

Bulletins of Diamond Alkali Co., 300 Union Commerce Bldg., Cleveland 14, O. **"Evaluation of Stabilizers for Vinyl Stocks Containing Chlorowax 40."** 11 pages. This bulletin reports the results of a laboratory study of two standard stabilizer formulations with respect to light and heat stability characteristics. Data on compositions, costs, and properties for some 22 different stabilizers are given, together with a list of stabilizers recommended for use in vinyl stocks containing Chlorowax 40. **"Evaluation of Inert Fillers in Vinyl Plastics."** Diamond Alkali Materials in Plastics, Bulletin #4. 10 pages. This bulletin reports on an evaluation study of the company's eight grades of precipitated calcium carbonates for use as fillers in vinyl compounds. Information covers formulations, effect of filler loadings on properties, and cost considerations.

"There Is Always Something New in Banbury Mixer Design." Farrel-Birmingham Co., Inc., Ansonia, Conn. 4 pages. This bulletin describes and illustrates the new Size 11 Uni-drive Banbury, a three-part machine for mixing stiffer stocks at higher speeds. The parts of this machine follow: (1) a separate housing enclosing all gears; (2) the universal spindles connecting the Uni-drive with the Banbury rotors, and (3) the mixer itself which has been strengthened to withstand the work of mixing stiffer stocks.

*** "Niacet Synthetic Organic Chemicals."** United States Vanadium Corp., Niagara Falls, N. Y. 52 pages. This twelfth edition of the company's catalog presents detailed data on the properties, specifications, applications, shipping, and handling of 19 chemicals, including vinyl acetate, acetaldehyde, acetonitrile, and acetic acid.

"The Story of Duco Finishes." E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del. 20 pages. This booklet provides a pictorial record of the history of Duco and its effect on the American scene.

"Neoprene Selector." This cardboard slide chart from du Pont is designed as a handy aid in the rapid selection of the proper neoprene type for use in a specific application. General-purpose and special-purpose types of neoprene appear on opposite sides of the chart. Setting the slide for any neoprene-type designation provides a brief description of the rubber and its suggested uses and also concise information on properties of the final product, processability with regard to mixing, calendering, extruding, and fabricating, and references to more detailed reports published by the company.

"Fully Automatic Molding of Thermosetting Plastics." F. J. Stokes Machine Co., Philadelphia, Pa. 24 pages. This illustrated brochure describes the origins and growth of automatic molding from the initial hand-mold press to the present fully automatic press. Typical applications of automatic molding are discussed and illustrated, and information is given on the cost savings obtained by use of this molding method.

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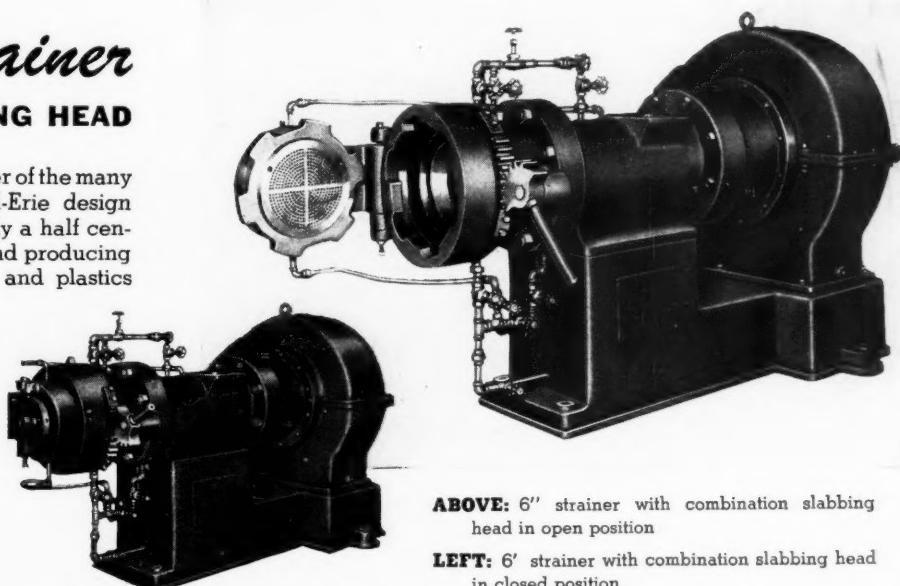
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LEFT: 6' strainer with combination slabbing head in closed position

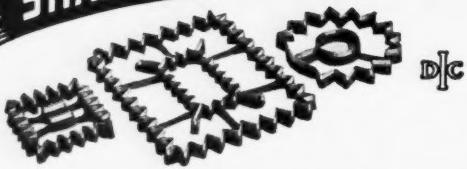
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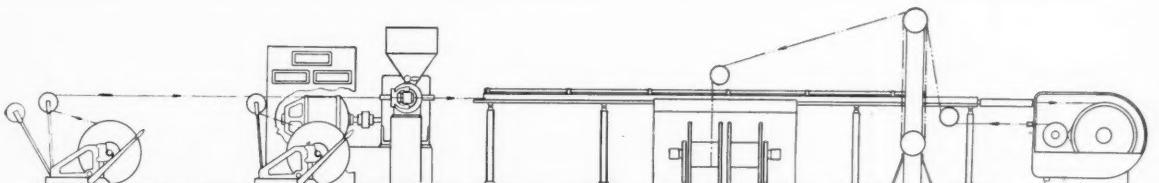
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MARKET REVIEWS

CRUDE RUBBER

Commodity Exchange

WEEK-END CLOSING PRICES

Futures	Oct.	Nov.	Dec.	Jan.	Jan.	
	28	25	23	30	6	13
Mar.	53.00	52.40	55.00	61.50	59.00	67.00
May	47.50	47.50	52.00	55.50	53.75	62.00
July	45.00	43.00	50.50	53.00	50.00	57.00
Total weekly sales, tons	3,250	3,870	1,210	1,660	320	280

TRADING in rubber futures on the New York Commodity Exchange during the second half of December was light as dealers awaited the announcement that the government would take over crude rubber buying and selling. This announcement came in an NPA order on December 28, which stated that, effective December 29, the General Services Administration would be exclusive buyer and seller of natural rubber imported into the United States. Following this announcement, the Exchange received a directive from Jess Larson, GSA administrator, that all open contracts must be registered with his office before January 5 and liquidated before March 31.

In accordance with this order the Exchange on January 2 ordered that trading in rubber futures be confined to the liquidation of open-interest contracts and set up a rubber liquidation committee to expedite this action. Transactions during January, therefore, consisted of long liquidation and short covering, with only March, May, and July contracting months being carried on the board.

March futures opened the period on December 18 at 55.50¢, fell to a low of 54.00¢ on December 19-21, rose to 61.50¢ on December 29, closed at 60.50¢ on January 2, and then rose irregularly on the strength of foreign markets to a high of 70.00¢ on January 15. The light market activity of December was reflected in the total sales volume of 9,130 tons, as compared with November's total of 19,200 tons. During the first half of January, only 640 tons were contracted for as dealers liquidated their holdings.

New York Outside Market

WEEK-END CLOSING PRICES

Spot Prices	Oct.	Nov.	Dec.	Dec.	Jan.	Jan.
	28	25	23	30	6	13
No. 1 R.S.S.	64.50	63.50	74.00	79.00	66.00	71.00
No. 3 R.S.S.	63.50	61.00	72.00	76.50	63.50	69.00
No. 2 Brown	58.50	56.50	67.00	72.00	58.00	60.00
Flat Bark	53.50	50.50	61.00	66.00	48.00	49.00

AS NOTED in the rubber futures market, activity in physical rubber trading on the New York Outside Market was light during the second part of December as dealers awaited the government announcement. Following this, dealer activity consisted of sales to the government and the balancing of books.

During the transition to complete government control of rubber imports, dealers were given considerable leeway, as follows: (1) dealers will be able to import rubber against short positions taken prior

to December 29, 1950; (2) dealers will also be permitted to import specific grades for contracts consummated prior to December 29; and (3) dealers will be allowed to buy foreign rubber to sell in foreign markets. Meanwhile the government will buy any grade of natural rubber offered by dealers up till June 30 and will not turn down any consignment of rubber after it arrives in this country. The government purchase price will depend on the price paid by dealers, but the rubber must be classified under RMA types.

For the first three months of government selling of rubber it is expected that the price will be made on a day-to-day basis and will be the market price of the previous day. A new selling system will be devised after this time. Rotation buying by manufacturers will be on a cash basis only, inasmuch as GSA does not have the same leeway as did the RFC.

The spot price for No. 1 R.S.S. started at 69.50¢ on December 18, rose to a high of 81.00¢ on December 28, closed the month at 79.00¢, was quoted at 78.00¢ on January 2, fell to a low of 66.00¢ on January 4-5, and then recovered to end at 71.50¢ on January 15. No. 3 sheets went from 71.00¢ on December 18 to 68.00¢ on January 15, with a high of 78.50¢ on December 28. No. 2 Brown fluctuated from 66.00¢ at the start of the period to 59.00¢ on January 15, and reached a high of 74.00¢ on December 28. Flat Bark moved from 61.00¢ on December 18 to a high of 68.00¢ on December 28 and closed at a low of 48.00¢ on January 15.

Latices

ON JANUARY 4 the General Services Administration authorized dealers to continue to import and distribute *Hevea* latex through January 31 in accordance with NPA regulations and for consumption in January. This revision of the regulations was necessary because the GSA was unable to complete latex arrangements in view of its work in inaugurating the crude rubber program, but is expected to take over *Hevea* latex on February 1. Frank Andruss and Dave Thomas will handle *Hevea* latex operations for GSA; the former will probably handle purchasing and distribution; while the latter will cover storage and maintenance.

According to Arthur Nolan, Latex & Rubber, Inc., many users of *Hevea* latex have already provided for their February requirements with their forward delivery contracts registered with GSA. While there has been no official announcement of GSA procedures for such transactions, it is expected that consumers who have to purchase latex during February will use the following method or some variation of it: (1) for latex in tankcar quantities the consumer will address his requisition to his preferred supplier, who will be an authorized agent for GSA and who will arrange the necessary clearance of quality, quantity, delivery, etc.; (2) for latex in drum or truck-tank quantities the consumer will make a direct purchase from his supplier, who in most cases will also be a GSA agent; and (3) in all cases the consumer must certify to his supplier that the latex will be used in strict conformance with NPA regulations.

There has been no change, to date, in the announced NPA permissible consumption, excluding defense orders, of 17,000 tons of latex during the first quarter of this year, although it seems unlikely that 6,000 tons will be consumed in January unless DO consumption increases. Many consumers will not use all the latex to which they are entitled because of high prices which have priced some products out of the market.

No official announcement has been made as to what the permissible usage of *Hevea* latex will be for the second quarter. There are to be Industry Advisory Group meetings before the NPA shortly, and it is expected that an announcement will be made at these meetings or soon after.

November imports of *Hevea* latex are estimated at 4,902 long tons, dry weight; consumption, 4,687 long tons; and month-end stocks, 5,593 long tons. First-quarter receipts are expected to be about 20,000 tons, but this figure may be exceeded because of heavy December requests for shipments from producers and the request to "load" latex for the United States made by the government on January 5. Mr. Nolan states that the almost total absence of government latex buying at world prices during recent weeks has unquestionably retarded production and, unless quickly rectified, may result in reduced receipts during the second quarter.

January supplies of *Hevea* latex appear to be all bought or earmarked for delivery. February receipts, while heavy, are practically all sold, with little or none available for additional government purchase. Some doubt exists as to whether the government will have sufficient latex available to satisfy all demands during February. Although the government has latex in stockpile, it is not known if this latex can be used for consumption requirements even on a loan basis. GSA is believed to have purchased quantities of latex drummed in the East, and February buyers may receive some of this latex while GSA is coordinating its supplies.

During December and the first half of January *Hevea* latex sold from 75-90¢ a pound. While no announcement of GSA pricing policy has been made, it is probable that the agency will resell latex to domestic consumers at a price which represents the acquisition cost over a particular period, plus costs of buying, storing, maintaining, handling, and distributing. There will probably also be a method whereby manufacturers who must contract to deliver products or latex compounds for future delivery can buy latex at fixed prices for forward deliveries.

As yet the GSA has not announced a policy regarding special latices. According to Mr. Nolan, users of such latices as heat concentrates, pentachlorophenol preserved, etc., will arrange with their preferred suppliers for such latices, and the GSA will permit a "wash sale" transaction on each case as it arises.

December production of GR-S latex is estimated at 2,382 long tons, dry weight, 322 tons below the November total. GR-S latex production is undergoing a planned increase to 4,000 tons a month by March, but it is unlikely that this rate will be achieved next month because of delays encountered in increasing solid GR-S production. At present most grades of GR-S latex are in short supply.

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RECLAIMED RUBBER

PRODUCTION and consumption of reclaimed rubber continued at peak levels during the period from December 16 to January 15. Demand continued to be high, but deliveries of inner tube reclaims are said to be uncertain owing to the short supply of tube scrap. Government restrictions on use of new rubber plus the high price of crude in comparison to reclaim have resulted in an increase in the consumption ratio of reclaim to new rubber of 5% in November, as compared to the October ratio. Consumption of new rubber in November fell off about 30% below the October level; while reclaim consumption dropped only 10%. An even further increase in the reclaim to new rubber consumption ratio is expected in December and January.

The reclaim industry foresees no let-up in demand for reclaim for at least the next year or two as the result of world demand for rubber and the national stockpiling program. In line with this belief one reclaiming firm has begun a substantial plant expansion program further to increase production.

Final October and preliminary November statistics on the domestic reclaimed rubber industry are now available. October production totaled 32,685 long tons; imports, 25 long tons; consumption, 32,785 long tons; exports, 989 long tons; and month-end stocks, 33,530 long tons. Preliminary figures for November show a production of 29,886 long tons; consumption, 29,800 long tons; exports, 1,237 long tons; and month-end stocks, 33,066 long tons.

Reclaimed Rubber Prices

	Sp. Gr.	per Lb.
Whole tire	1.18-1.20	10.00/10.75
Peel	1.18-1.20	nom.
Inner tube		
Black	1.20-1.22	nom.
Red	1.20-1.22	nom.
GR-S	1.18-1.20	nom.
Butyl	1.16-1.18	nom.

The above list includes those items or classes only that determine the price basis of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims in each general group separately featuring characteristic properties of quality, workability, and gravity at special prices.

SCRAP RUBBER

THE scrap rubber market displayed a firm tone during the period from December 16 to January 15. The usual year-end slowdown came late in December, but business picked up in January, and shipments of scrap rubber moved in good volume. Scrap tires prices showed no changes during the period, but some tightness in scrap tubes was reflected by 3¢ a pound increases in the prices of red and black auto tubes. Numerous export inquiries were received by the market, but actual orders were few and concentrated in specialty items.

The outlook for the scrap rubber industry during 1951 is favorable, and demand for scrap is expected to be at high levels throughout the year. The trade is watching Washington developments in the belief that some form of price controls over scrap will be instituted within the near future.

Following are dealers' selling prices for scrap rubber, in carload lots, delivered to mills at the points indicated:

	Eastern Points (Per Net Ton)	Akron O. (per Lb.)
Mixed auto tires	\$28.00	\$31.00
Peelings, No. 1	60.00	60.00
3.....	35.00	35.00
Black inner tubes	9.00	9.00
Red passenger tubes	13.00	13.00

COTTON AND FABRICS

NEW YORK COTTON EXCHANGE WEEK-END CLOSING PRICES

Futures	Oct.	Nov.	Dec.	Jan.	Jan.
	28	25	23	30	6
Mar.	40.60	42.87	42.95	43.05	43.02
May	40.36	42.14	42.50	42.51	42.65
July	39.94	41.40	41.91	41.86	42.27
Oct.	36.40	36.35	38.89	39.18	39.70
Dec.	36.28	35.80	38.52	38.72	39.32
Mar.	36.20	35.70	38.42	38.46	39.15

RISING prices and a firm tone featured cotton trading on the New York Cotton Exchange during the period from December 16 to January 15. The market firmness resulted from strong domestic and export demand, the advance in the December parity price, the tight supply situation, and the belief that cotton growers will not produce the 16,000,000-bale crop set by the government as the goal this year. New record highs were set by spot and March futures prices on January 11, culminating the advance, and eased off at the end of the period in the face of reports of more stringent controls over commodity transactions.

The Exchange placed domestic cotton consumption for the season through December 30 at 4,355,000 bales, which rate, if maintained, would give a total consumption for the crop year of 10,570,000 bales, as compared with 8,851,000 bales in 1949-1950. If exports do not exceed the 4,000,000-bale level set by the government, the carry-over on July 31 will be about 2,300,000 bales, the smallest figure since 1925. Market observers, however, state that at least a fair part of the cotton used thus far has probably gone into reserve stocks in anticipation of expanded military requirements. If international tension should ease, mills will reduce their reserve stocks at the expense of further buying on the market and thus ease the supply situation to some extent.

The 15/16-inch middling spot price began the period at 43.77¢, closed at 44.17¢ on December 29 and 44.28¢ on January 2, rose to a record high of 45.20¢ on January 11, and closed the period at 45.00¢. Futures prices showed similar movement; March futures rose from 42.65¢ on December 16, 43.05¢ on December 29, and 43.16¢ on January 2, to a record peak of 44.10¢ on January 11, and then declined to end the period at 43.91¢.

Fabrics

The tight supply situation in industrial gray goods was further intensified during the period from December 16 to January 15 by stepped up government buying. Ducks are in especially tight supply, and it may be necessary for the government to call in emergency duck producers, such as carpet and upholstery mills, within the near future. Many regular producers have already made changes in their operating schedules and have converted looms to meet military specifications; while others are contemplating similar moves.

Little change in the industrial fabric

picture took place during the period. Most mills report their production sold out for the second quarter, and substantial quantities sold into the third quarter. There were few changes in fabric prices, but the prospect of a rise in labor costs after present contracts expire is impelling many mills to place a wage or labor escalator clause on their selling contracts. In addition, the rising price of raw cotton, if unchecked, will also bring higher fabric prices.

Cotton Fabrics

Drills

5 1/2-inch	1.85-yd.	yd.	\$0.49
	2.25-yd.	yd.	.42

Ducks

38-inch	1.78-yd.	S. F.	.4875 / .495
2.00-in.	2.00-yd.	S. F.	.445 / .45
51.5-inch	1.35-yd.	S. F.	.645 / .655

Hose and belting

Osnaburgs

40-inch	2.11 yd.	yd.	.36
	3.65-yd.	yd.	.225

Raincoat Fabrics

Bombazine	64x60	5.35-yd...yd.	nom.
Print cloth	38 1/2-in.	64x60...	.225
Sheeting	48-inch	4.17-yd.	.26%
		52-inch	.29%

Chafer Fabrics

14-oz./sq.	yd.	Pl.	.84 / .865
11.65-oz./sq.	yd.	S.	.78
10.80-oz./sq.	yd.	S.	.8175 / .82
8.9-oz./sq.	yd.	S.	.83 / .845

Other Fabrics

Headlining	58-inch	1.35-yd.	.62
2-ply		2-ply	.62
64-inch	1.25-yd.	2-ply	.725
Sateens	53-inch	1.32-yd.	.71 / .725
		58-inch	.775 / .78

Tire Cords

K. P. std.	12-3-3	lb.	nom.
	12-4-2	lb.	.95

RAYON

ACCORDING to a recent survey by the Textile Economics Bureau, Inc., the capacity of the domestic rayon producing industry as of mid-November totaled 1,306,000,000 pounds on an annual basis of 52 weeks. By mid-1951 the rayon capacity is expected further to increase to 1,383,000,000 pounds and to 1,520,000,000 pounds by October, 1952.

Viscose high-tenacity yarn capacity in mid-November was 326,000,000 pounds per year, with the average denier spun 1597. It is anticipated that by July the capacity will increase by 6% to 345,000,000 pounds, with an average denier of 1602. In November the percentage of this capacity in individual deniers was as follows: 1100 denier, 16%; 1650 denier, 75%; and 2200 denier and over, 9%. By July these percentages are expected to be as follows: 1100 denier, 14%; 1650 denier, 78%; and 2200 denier and over, 8%.

Rayon Prices

Tire Yarns	\$0.62/\$0.63
1100/480	.62
1100/490	.62
1150/490	.62
1650/720	.61 / .62
1650/980	.61
1900/980	.61
2200/960	.61
2200/980	.60
4400/2934	.63

Tire Fabrics

1100/490/2	.72
1650/980/2	.695 / .73
2200/980/2	.685

U. S. Imports, Exports, and Reexports of Crude and Manufactured Rubber

October, 1950		October, 1950		October, 1950	
Quantity	Value	Quantity	Value	Quantity	Value
Imports for Consumption of Crude and Manufactured Rubber					
UNMANUFACTURED, Lbs.					
Crude rubber	163,978,985	\$53,151,003			
Latex	11,559,808	5,485,816			
Crude chicle	304,868	334,191			
Guayule	22,400	7,496			
Balata	1,657,788	788,135			
Jelutong or Pontianak	478,325	183,907			
Gutta percha	115,197	102,599			
Synthetic rubber	3,547,805	642,812			
Reclaimed rubber	56,000	2,030			
Scrap rubber	14,524,786	359,467			
TOTALS	196,246,052	\$60,857,457			
MANUFACTURED					
Tire and casings: auto, etc. no.	5,278	\$94,769			
Bicycle no.	6,871	5,958			
Other no.	10	1,170			
Inner tubes: auto, etc. no.	758	1,393			
Rubber footwear:					
Boots prs.	80,451	249,205			
Shoes and overshoes prs.	16,234	13,217			
Rubber-soled canvas shoes prs.	6,072	7,129			
Athletic balls: golf no.	58,776	15,719			
Tennis no.	24,780	6,672			
Other no.	40,802	1,942			
Rubber toys, except balloons	33,276				
Hard rubber goods	36,226				
Rubberized printing blankets lbs.	1,064	2,856			
Rubber and cotton packing lbs.	6,771	9,127			
Gaskets and valve packing	163				
Molded insulators	2,298				
Belting lbs.	19,208	22,156			
Hose and tubing	2,063				
Drug sundries	11,487				
Instruments doz.	2,041	9,564			
Other rubber products	323				
Golf ball centers doz.	371	385			
Heels and soles lbs.	34	77			
Rubber bands lbs.	2,490	3,276			
Synthetic rubber goods	35				
Other soft rubber goods	165,768				
TOTALS	\$696,254				
GRAND TOTALS, ALL RUBBER IMPORTS	\$61,553,711				
Reexports of Foreign Merchandise					
UNMANUFACTURED, Lbs.					
Crude rubber	1,264,286	\$500,623			
Balata	11,194	3,806			
Scrap rubber	30,157	3,016			
TOTALS	1,305,637	\$507,445			
MANUFACTURED					
Rubber footwear: boots prs.	5,000	\$1,400			
Drug sundries, except hot water bottles and fountain syringes	115				
Rubber and rubberized clothing	4,720				
Toys and balls	1,787				
TOTALS		\$8,022			
GRAND TOTALS, ALL RUBBER REEXPORTS		\$515,467			
Exports of Domestic Merchandise					
UNMANUFACTURED, Lbs.					
Crude rubber	2,030	\$610			
Chicle and chewing gum bases	358,331	133,759			
Synthetic rubbers: GR-S	78,933	56,362			
Butyl	16,610	2,874			
Neoprene	1,067,079	390,106			
Nitrile	332,742	149,145			
"Thiokol"	1,254	1,470			
Polyisobutylene	10,718	2,063			
Other	10,784	4,849			
Reclaimed rubber	2,216,183	203,049			
Scrap rubber	5,520,625	149,726			
TOTALS	9,615,289	\$1,094,013			
MANUFACTURED					
Rubber cement gals.	114,235	\$233,060			
Rubberized fabric: auto cloth sq. yds.	2,136	2,664			
Piece goods and hospital sheeting sq. yds.	87,560	76,862			
Rubber footwear: boots prs.	5,991	28,222			
Shoes prs.	5,121	6,210			
Rubber-soled canvas shoes prs.	23,138	40,662			
Soles doz. prs.	22,630	57,196			
Gutta percha manufactures lbs.					
Rubber heels doz. prs.	65,182	\$62,328			
Soling and toplift sheets lbs.	674,327	120,105			
Gloves and mittens doz. prs.	16,787	51,327			
Drug sundries: hot water bottles and fountain syringes no.	21,514	13,847			
Other		193,003			
Rubber and rubberized clothing		92,606			
Toy and novelty balloons		56,395			
Rubber toys and balls		61,614			
Erasers lbs.	27,603	21,685			
Hard rubber goods: battery boxes no.	21,849	38,261			
Other electrical goods lbs.	163,479	72,046			
Combs, finished doz.	5,118	8,549			
Other		9,215			
Tires and casings: truck and bus no.	50,315	1,973,379			
Auto no.	58,177	865,641			
Aircraft		99,840			
Farm tractor, etc no.	3,453	136,563			
Other off-the-road no.	5,457	508,497			
Bicycle no.	13,138	16,234			
Motorcycle no.	516	4,877			
Other no.	915	33,278			
Inner tubes: auto no.	44,824	104,689			
Truck and bus no.	23,522	93,107			
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Other no.	14,669	37,754			
Solid tires: truck and industrial no.	1,261	52,419			
Tire repair materials: camelback lbs.	115,144	36,100			
Other lbs.	221,382	163,462			
Rubber and friction tape lbs.	36,424	24,673			
Belting: auto and home lbs.	72,490	91,178			
Transmission: V-belts lbs.	96,031	179,572			
Flat belts lbs.	27,001	31,761			
Other lbs.	25,245	21,509			
Conveyer and levator lbs.	39,563	40,383			
Other lbs.	1,977	2,923			
Hose and tubings lbs.	442,697	338,561			
Packing lbs.	188,138	158,355			
Mats, flooring, tiling lbs.	582,501	137,033			
Thread: bare lbs.	30,911	40,598			
Textile covered lbs.	15,990	46,335			
Gutta percha manufacturers lbs.	882	1,586			

Estimated Automotive Pneumatic Casings and Tube Shipments, Production, Inventory, November, October, 1950; First 11 Months, 1950. 1949

SOURCE: Bureau of Census, United States Department of Commerce, Washington, D. C.

Compounding Ingredients — Price Changes and Additions

Accelerator-Activators, Organic		
Emersol 110.....	.lb.	\$0.2575 / \$0.27
120.....	.lb.	.2625 / .275
130.....	.lb.	.285 / .2975
210 Elaine.....	.lb.	.2625 / .29
Emery 600.....	.lb.	.205 / .225
Hyfac 430.....	.lb.	.2475 / .26
431.....	.lb.	.2575 / .27
Ridacto.....	.lb.	.25 / .26

Chemical Stabilizers		
Dutch Boy DS-207.....	.lb.	\$0.57 / \$0.59
Dyphos.....	.lb.	.5875 / .6075
Dythal.....	.lb.	.415 / .435
Normalasal.....	.lb.	.4675 / .4875
Plumb-O-Sil A.....	.lb.	.2925 / .3125
B.....	.lb.	.3075 / .3275
C.....	.lb.	.3325 / .3525
Tribase.....	.lb.	.265 / .285
E.....	.lb.	.2325 / .2525

Mold Lubricants

NOTE: Cumulative data on this report include adjustments made in prior months.
SOURCE: The Rubber Manufacturers Association, Inc., New York, N.Y.

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ASSISTANT SUPERINTENDENT, TIME AND METHODS ENGINEER with 17 years' experience in rubber footwear and clothing, desires new position. Address Box No. 719, care of INDIA RUBBER WORLD.

EXECUTIVE — GRADUATE CHEMICAL ENGINEER, AGE 45, with 24 years' general management, production, and technical experience in most types of mechanical rubber goods. Desire connection as factory or general manager with progressive medium sized company. Address Box No. 720, care of INDIA RUBBER WORLD.

RUBBER CHEMIST—FULL OR PART TIME. FIVE YEARS' experience compounding; lab., factory management, large, small plants. Excellent record. Akron area. Address Box No. 721, care of INDIA RUBBER WORLD.

LATEX SPECIALIST SEEKS CHANGE. SMALL COMPANY preferred. Training: Chemistry and Business Administration (Degree). Twenty years' experience from bottom to management general latex work, colloids, reclaim dispersions; development, production, sales. Excellent references. Address Box No. 722, care of INDIA RUBBER WORLD.

CHEMIST-ENGINEER TECHNICAL SUPERINTENDENT WITH 20 years' experience in the manufacture of tires, mechanicals, floor tile, shoe materials, adhesives, wants technical or management position. Address Box No. 728, care of INDIA RUBBER WORLD.

ENGINEER, 34, MARRIED, ALIEN RESIDING U.S.A. PERMANENTLY, master degree of mechanical engineering, several years' rubber factory experience on various products and some training in American rubber machinery plant. Desires permanent position in engineering or development work in rubber or tire factory or rubber machinery manufacture. References available. Address Box No. 730, care of INDIA RUBBER WORLD.

LATEX FOAM PRODUCTION CHEMIST. HEAVY EXPERIENCE in layout of conveyor systems for continuous foaming, vulcanizing, washing, and drying of all types of latex foam products. Proven ability in development of special compounds. In seven years of latex foam experience have had titles of chief chemist and general manager. Present salary, \$8,000. Address Box No. 731, care of INDIA RUBBER WORLD.

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Continued

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FOR SALE: BANBURY MIXERS, MILLS, CALENDERS, LABORATORY MILL and Banbury Unit, Extruders, Tubs, Hydraulic Presses. Send for detailed bulletin. EAGLE INDUSTRIES, Inc., 110 Washington Street, New York 6, N. Y. Digby 4-8364-5-6.

BANBURY PARTS: ROTORS, END FRAMES, ROTOR COLLARS, door tops, and other parts for Banbury's #3, #3A, #9, and #11. Every part rebuilt to A-1 condition. For emergency repairs, or for complete rebuilding, write or wire INTERSTATE WELDING SERVICE, Office, Metropolitan Building, Akron 8, Ohio.

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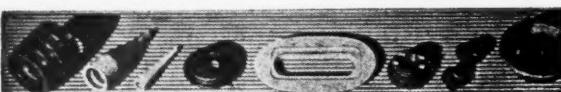
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—the work moves along
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